

# Environmental Assessment Report

---

Environmental Impact Assessment  
September 2010

## L2612- PHI: Visayas Base Load Power Project – Secured Landfill Facility

Prepared by Provincial Government of Cebu

The environmental impact assessment is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature. Your attention is directed to the "Terms of Use" section of this website.

# TABLE OF CONTENTS

1.	BASIC PROJECT INFORMATION.....	1
2.	DESCRIPTION OF THE EIA PROCESS.....	2
2.1.	Terms of Reference of the EIA Study.....	2
2.2.	EIA Team .....	3
2.3.	Status of the Project .....	3
2.4.	EIA Study Schedule.....	3
2.5.	EIA Study Area .....	3
2.6.	EIA Methodology .....	4
3.	PROJECT DESCRIPTION .....	5
3.1.	Project Location and Area .....	5
3.2.	Project Rationale .....	5
3.3.	Project Development Plan, Process/Technology and Project Components .....	5
3.4.	Description of Project Phases.....	10
3.5.	Manpower Requirements for the Construction Phase .....	13
3.6.	Project Cost.....	13
3.7.	Project Duration and Schedule.....	13
4.	BASELINE ENVIRONMENTAL CONDITION .....	14
4.1.	The Land .....	14
4.2.	The Water.....	21
4.3.	The Air.....	29
4.4.	The People .....	31
5.	IMPACT ASSESSMENT AND MITIGATION .....	36
6.	ALTERNATIVES WITH OR WITHOUT THE PROJECT.....	44
7.	ENVIRONMENTAL MANAGEMENT PLAN.....	46
7.1.	Impact Management Plan.....	46
7.2.	Environmental Monitoring Plan.....	51

7.3	Institutional Plan .....	53
8	CONCLUSION AND RECOMMENDATION .....	54
9	BIBLIOGRAPHY/REFERENCES .....	55
10	ANNEXES .....	56

# 1. BASIC PROJECT INFORMATION

1.1.	NAME OF THE PROJECT	SECURED LANDFILL FACILITY PROJECT
1.2.	NAME OF PROPONENT	PROVINCIAL GOVERNMENT OF CEBU
1.3.	CONTACT PERSON	HON. GWENDOLYN F. GARCIA
1.4.	ADDRESS	Capitol Compound, Cebu City
1.5.	CONTACT NUMBER	032-253-6070 / 032-254-2328



## 2. DESCRIPTION OF THE EIA PROCESS

### 2.1. Terms of Reference of the EIA Study

An Environmental Impact Assessment (EIA) is “a formal process of identifying and predicting the impacts of a proposed action on environmental integrity and human welfare and communicating the information about such impacts to planners and decision makers” (EMB Training Module No. 10)

The EIA study aims to determine and assess the direct and indirect environmental impacts of the development projects prior to its implementation so that proper mitigating measures may be formulated.

- The general approach of the conduct of the EIA study shall be based on the annotated outline for IEE Report as presented in the Revised Procedural Manual for DAO 03-30, Annex 2\_15.
- Attachments, Annexes, Appendices to the IEER shall follow the Procedural Manual DAO 03-30
- The IEER shall comply with the DENR EIA Review Criteria
- The IEER shall cover IEA study on the Physical, Biological and Social aspect affected by the project
- Policy, Legal and Administrative Framework

The Environmental Impact Assessment (EIA) is conducted pursuant to Presidential Decree No. 1586 or the Philippine Environmental Impact Statement System (PEISS), the main law that governs EIA in the country

In the course of the review of the EIA study, there are certain existing laws and legal orders that should be considered. Among these are the following:

Legislative and Regulatory Considerations	
Standards Governing Environmental Quality	DAO 34, 35, 14, 29 PD 984, RA 8731, etc.
Health and Safety	OSHS(DOLE) and HIA (DOH), P.D. 856, etc
Protection of Sensitive Areas, endangered species, etc.	PD 1067 (Water Code), Fisheries Code, International Maritime Organization (IMO), DOT (Tourism Areas)
Land Use/Coastal Classification	Local Government Code/BFAR-DA
Sewerage and Drainage System	PD 856, PD 1067 (Water Code)
Toxic and Hazardous Waste	RA 6969

**2.2. EIA Team**

- Polygon General Engineering Consultancy, construction (PGECC), EIA Consultant, Biology, Environmental Impact Assessment
- Provincial Planning and Development Office– Socio-Economics, Public Consultation
- Provincial Engineering Office - Engineering
- KEPCO – Coal Ash Management and Disposal

**2.3. Status of the Project**

The proposed project is still in the process in securing permits and clearances. The project development will start on August 2010.

**2.4. EIA Study Schedule**

The EIA technical scoping was conducted in the EMB Regional Office on February 2010. The EIA proper starts after convening the IEA team to conduct the appropriate study. The EIA report to be submitted is the Initial Environmental Examination Report as basis for the evaluation of the application of Environmental Compliance Certificate (ECC). The IEER will be based on the standard outline stipulated in DAO 2003-30. The study was completed in June 17, 2010.

Completion of the studies, issuance of the ECC and the procurement of all the supporting documents necessary for the project to commence has to be secured by the group tasked to do the job by the end of the July 2010. The Cebu Provincial Government expects the project to be initiated for implementation by the 3<sup>rd</sup> Quarter of CY 2010.

**Table 1. IEE Process documentation and study schedule**

Activities	Schedule (mo.)		
	1	2	3
Project Scoping			
Info/Data gathering			
Identification of potential impacts			
Assessment of significant environmental issues			
Prep. of an environmental management plan			
Submission of IEER for ECC Issuance			

**2.5. EIA Study Area**

The study area will focus on the titled property of the Provincial Government of Cebu under Psu – 07-01-002299, Lot 1, Plan Sp-07-01-000062, Plan Sp-07-01-000048, Plan SP-07-01-000047, Lot 1, Plan Sp-07-01-00047, Plan Sp 07-01-000063, Lot 2, Plan Sp 07-01-000062, Lot 1, Psu-07-002298, Lot 2, Psu-07-01-002298 and Lot C-4-A located in Barangay Tinaan, Naga, Cebu. An approximately 232,000 square meters will be develop into a secured

landfill facility. The EIA Study also includes the effects of the project on the areas considered as the secondary impact areas. This area includes the Barangays adjacent to the project site within the City of Naga. The proposed Secured Landfill Facility Project is geographically located within N 10°11'26.3" and E 123°44'38.3".

## **2.6. EIA Methodology**

The IEE for this project encompasses the Physico-chemical, biological, socio-cultural dimensions of the affected environment. The study involves the following stages:

- a. Preliminary Preparation
- b. Final Preparation and Mobilization
- c. Baseline studies, eco profiling and validation
- d. Impact identification and prediction
- e. Proposals of environmental mitigating measures that will mitigate and/or offset negative impacts and enhance positive impacts
- f. Environmental Management Planning
- g. Preparation of IEE Report

# 3. PROJECT DESCRIPTION

## 3.1. Project Location and Area

The Project is located in Barangay Tina-an, one of the Coastal Industrial Corridor of Naga City, where most of the existing industrial establishments are located. The project site is situated at the titled Property of the Province of Cebu. It is approximately 120 meters away from the national road which is next to Barangay Poblacion at the northern side and fronting the seawater of Bohol Strait at the eastern side of Naga City.

Naga shares political boundaries at the northern side of the Municipality of Minglanilla, Municipality of San Fernando in the southern part and at the eastern side by Bohol Strait and on the western side of Toledo City. The total area to be develop for the proposed Secured Landfill Facility is 232,000 square meters.

## 3.2. Project Rationale

Naga City is classified as the industrial arm of the Province of Cebu. It plays a major role in the economic growth and development at the Southern Part of the Island. It is the site of many industries and currently functioning as a highly urbanized center that focused more on industrial development. The operation of the KEPCO Coal Powered Power Plant is one of the focus particularly on the disposal of Coal Ash as waste material of the Power Plant.

The provincial government has a 24.9 hectares titled property located in Barangay Tinaan and has decided to develop the 23.2 hectares into a Secured Landfill for the secure dumping of coal ash materials produced by the Coal Fired Power Plant of Kepco located at Barangay Colon, City of Naga.

The proposed Secured Landfill Facility project shall have a total area of 23.2 hectares comprises of the following developments:

1. Dry Land ( Field Office, Parking Space, access roads and Green Areas) - 1.8 hectares
  - a. Silt Pond – .5 hectares
  - b. Stockpile Area for Limestone – 1 hectare
  - c. Stockpile Area for Bentonite Clay - .5 hectare
  - d. Stockpile Area For Construction Materials and wastes – 1.5 hectares
2. Landfill Facility – 17.6 hectares
3. Retaining Wall/Embankment - .2384 hectares

The landfill is projected to be operational for six (6) years utmost. Land development projects will be introduced after the operation of the landfill area.

## 3.3. Project Development Plan, Process/Technology and Project Components

The proposed Secured Landfill Project involves the following activities and components:

1. Establishment of visible construction markers – Before the commencement of construction works, the Contactor together with the Engineer of Authority/Employer conducts survey which will form basis of quantity measurement. Prior to placement of any material, the Contractor have established visible construction markers to clearly define horizontal limits of the work.
2. Mobilization and Delivery of Construction Materials – Materials and Equipment that will be used for construction will be mobilized and delivered into the project site. Construction materials shall be made available for start of construction.



3. Land Clearing and Grubbing – The project site shall be cleared from small vegetation to make way for the construction equipment and vehicles. Small vegetation (aroma) and grasses shall be cleared.
4. Access Road Development – A road from the National Highway shall be opened with width that can accommodate entry of large vehicles and equipment which will be used for the construction.
5. Construction of Silt Pond – Simultaneous to Construction of Retaining Walls, A silt pond shall be constructed for run off water. Run off water from the low lying area impounded as result of rainfall shall be pumped out to the silt pond before discharge to existing drainage.
6. Reclamation Activity –The reclamation activity includes:
  - i. Construction of Retaining Walls and Embankments– Retaining Walls will be constructed using Pile Drives covering a length of 1,500 meters and width of .7 meters. Embankments shall be constructed within the inner part of the proposed secured landfill (existing fishpond) using stone masonry and riprap. The total length of the embankment is 1,334.35 meters and width of 1 meter. The existing riprap of the fishpond will be rehabilitation and improved to become the embankment of the project. Embankment material will be Armour rocks including grouted riprap and geotextile and also pave the bed with bentonite clay or HDPE liner. This will prevent intrusion of coal ash materials to the aquifer and prevent sea water intrusion within the area.

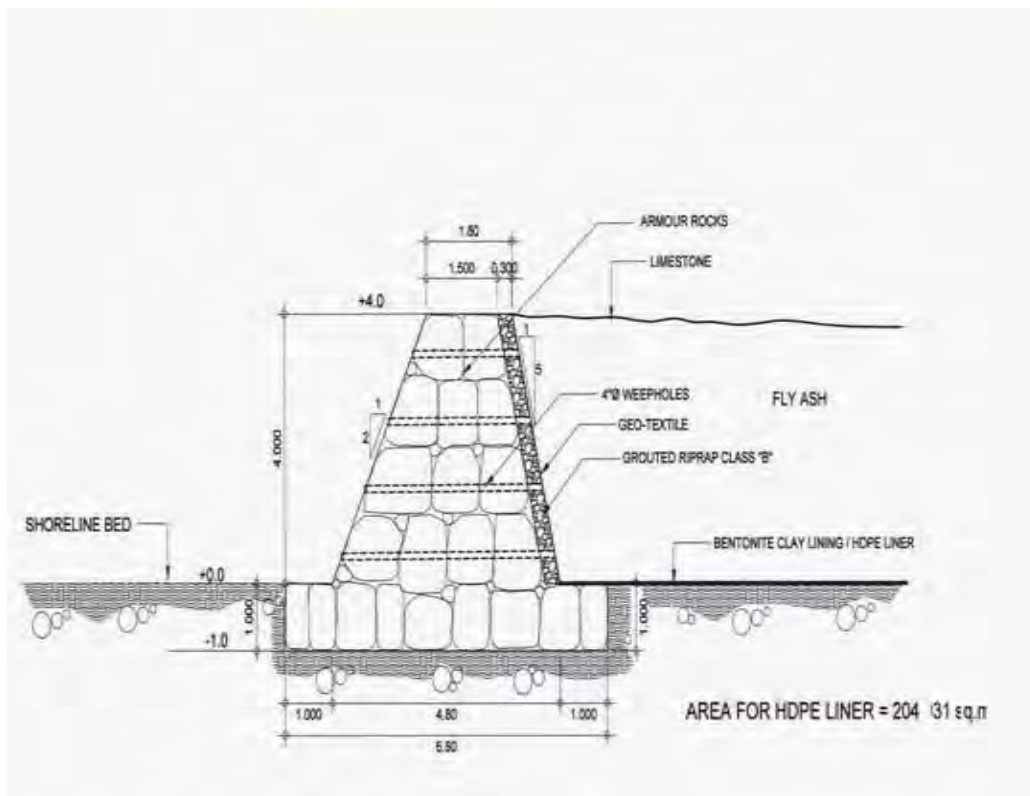


Figure 1. Embankment Design

- ii. Installation of Geotextile Sheet – Geotextile sheet shall be installed within the walls of the embankment and retaining wall prior to other activities.
- iii. Draining Water from existing fishpond – After the construction of the Retaining Wall and Embankments, water impounded inside the retaining wall and embankment shall be drained using draining equipment.
- iv. Removal of existing live fauna within the reclaimed areas – The remaining fauna that are trapped inside the retaining walls shall be transferred to area outside the project site.

- v. Filling the area with limestone – Limestone soil will be used as filling material for reclamation. The bottom will be leveled in preparation for development for secured landfill
7. Development for Secured Landfill – After reclamation of the bottom portion, development for secured landfill will start with the following activities:
- i. Installation of Bentonite Clay Lining– HDPE Liner shall be installed within the flooring of the landfill area as barrier to avoid seepage from the landfill area. The Bentonite clay soil used in the first layer shows plasticity and hardened when dried. It becomes silicate bearing material which are very effective in preventing percolation of coal ash that may sipped into the ground water which may adversely affect the water quality or will assimilate into the sea water eventually polluting the marine ecosystem.
  - ii. Installation of High Density Polyethelene Sheet (HDPE) Liner – Right after the Bentonite Clay lining is placed, HDPE liner shall be overlaid over the Bentonite Clay to ensure containment of coal ash.
  - iii. Dumping of Coal Ash - Waste material particularly coal ash from KEPCO Power Plant will be the only waste that will be dumped in the area. An effective method or process of filling coal ash from transportation to dumping shall be implemented by the proponent of the project.
  - iv. Constant spraying of water during dumping of coal ash to the secured landfill. A water truck and personnel shall be assigned for watering during backfilling of coal ash.
  - v. Ash unloaded on the landfill facility will be spread throughout the landfill using a dozer or its equivalent. The ash will then be gradually covered with or topped by limestone until each portion of the area is filled up with ash and limestone.
  - vi. The final grade of the Secured Landfill shall be covered with Limestone approximately .6 meters width.

### **Coal Ash Production Schedule**

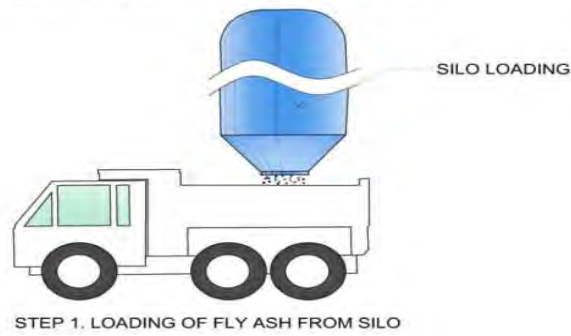
Industrial Waste material that will be dumped in the secured landfill facility is coal ash (taken from the coal-combustion by-products, known as “Fly Ash and Bed Ash” that will be generated from the 200megawatt circulating fluidized bed combustion (CFBC) coal-fired power plant managed and owned by the KEPCO SPC Power Corporation (KSPC). It is a process of deriving usable materials from by-products of the power facility and limestone which will be taken from registered and legal sources within the region. The estimated coal ash that will be filled in the landfill is 525,480 cubic meters and 52,547 cubic meters of limestone

An average of 240.6 cubic meters of coal ash will be backfilled to the Secured Landfill site per day.

### **Methodology of Coal Ash Backfill (Loading to Filling)**

- (a) Loading and Transportation of Ash
  - o A monitoring team will be organized by FDRC or transportation company to constantly monitor the activities of its personnel and to ensure that these are done in accordance with DENR-EMB standards and procedures in handling the agreed works.
  - o Ash discharge coming from KSPC will be loaded into a dump truck through a silo. It should be noted that the ash shall be loaded in such a way that spillage will be avoided. Dump trucks will be retrofitted in such a way that the cargo box opening will match that of the silo's opening. With this, only a small portion of the opening will need to be covered. Four (4) units of dump trucks, with 20 tons capacity each, will be assigned while one (1) unit spare dump truck will be on standby in case of breakdown of any of those in the project.

### SILO TO DESIGNATED DUMP SITE



- Loaded ash shall be covered by a duly approved material during the transportation to minimize or eliminate spillage. Personnel will be assigned to spray water on the loaded truck to stabilize the dust particles. From the silo, the dump trucks will then travel to the truck scale for weighing. After weighing, the trucks will then proceed to the proposed Secured Landfill site for backfilling of coal ash. Along the hauling route, a water truck will be assigned to constantly water the road leading to the project site as may be required.

### TRANSPORT OF FLY ASH



### (b) Dumping of Ash

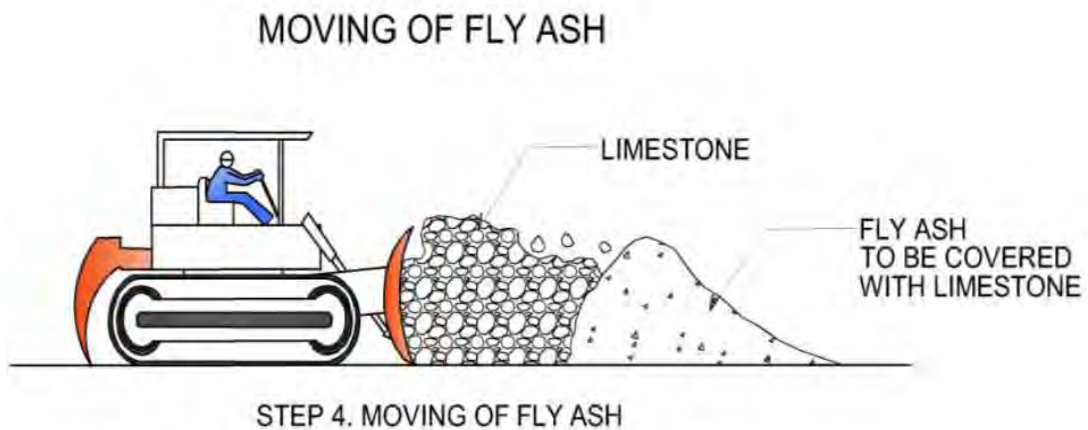
- The ash weight of all trucks coming in shall be checked before dumping. Manpower will also be assigned on the backfilling area for watering the ash especially those about to be dumped to minimize dusts. Water will be sourced from the from the sea and water will be controlled for just moistening the materials. Directional signs and traffic controls will be established at the landfill facility for proper guidance on priority areas and on the use of dumping equipment.

### DUMPING OF FLY ASH



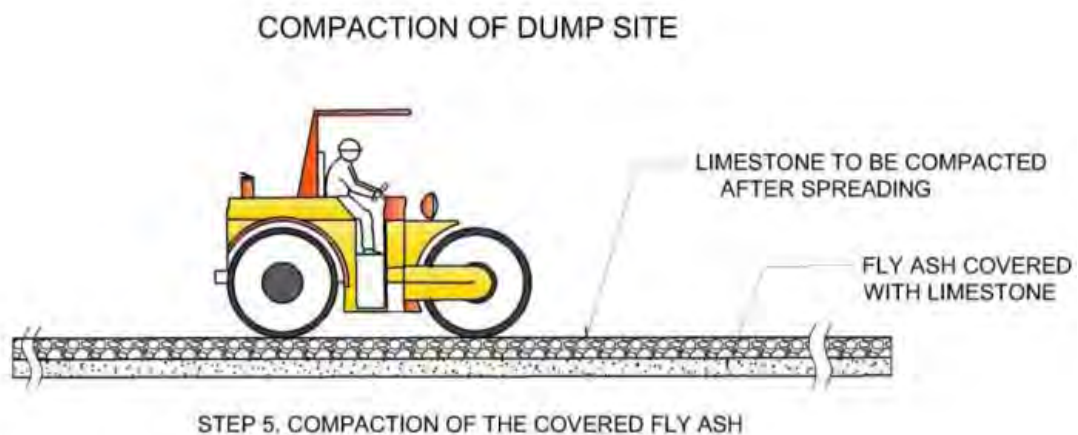
(c) Moving of Ash

- Ash unloaded on the landfill facility will be spread throughout the landfill using a dozer or its equivalent. The ash will then be gradually covered with or topped by soil and/or limestone until each portion of the area is filled up with ash and limestone. For easy access of the dumping equipment, road network on the Secured Landfill site shall be developed and it shall be compacted. The road shall be maintained in such a way that it will still be open for traffic for any weather condition. The finished top elevation of the landfill will be 2.65 m ( + 1.96 mean MSL) .
- A water truck will be on standby for the watering of the ash deposited to the landfill facility.



(d) Compaction of Ash

- To reduce the dumped ash physically and to enhance the compaction of landfill facility, a roller will be used. The top soil of the dump site will be protected from wind blows because of the designed elevation of the landfill facility and the compaction will be useful in the soil stabilization of the area for future usage.
- If necessary, greening and vegetation in the area, especially on the perimeter of the property will commence.



### **3.4. Description of Project Phases**

#### **3.4.1. Pre-Construction/Operational Phase**

Pre-construction activities that were conducted prior to the construction of Secured Landfill Facility Project includes:

- Survey Works
- Fencing
- Road Opening
- Secure contract with KEPCO to dump Coal Ash within the landfill site

#### **3.4.2. Construction Phase**

The major activities during construction phase are: the construction of the retaining walls to enclose the site, Reclamation and coal ash filling.

##### **3.4.2.1. Mobilization and Delivery of Construction Materials**

Materials and Equipment that will be used for construction will be mobilized and delivered into the project site. Construction materials shall be made available for start of construction.

##### **3.4.2.2. Construction of Site Management Office**

The construction of a temporary office and bunkhouse will be done. The temporary office house will be utilized by engineering department on the activities such as checking of construction material deliveries and other clerical jobs. The temporary bunkhouse shall serve as resting area for workers during construction period.

##### **3.4.2.3. Access Road Development**

A road from the National Highway shall be opened with width that can accommodate entry of large vehicles and equipment which will be used for the construction. Appropriate clearing and grubbing shall be conducted to clear the site for road development.

##### **3.4.2.4. Construction of Silt Pond – Simultaneous to Construction of Retaining Walls, A silt pond shall be constructed for run off water. Run off water from the low lying area impounded as result of rainfall shall be pumped out to the silt pond before discharge to existing drainage**

##### **3.4.2.5. Reclamation**

###### **3.4.2.5.1. Construction of Embankment and Retaining Walls**

Upon commencement, the process of construction starts with excavation and laying of foundation with a length of 1 meter and a depth of 2 meters that will serve as a footing to carry and stabilize the weight of the retaining wall. Retaining Walls will be constructed using Pile Drives covering a length of 1,500 meters and width of .7 meters. Embankments shall be constructed within the inner part of the proposed secured landfill (existing fishpond) using stone masonry and riprap. The total length of the embankment is 1,334.35 meters and width of 1 meter. The existing riprap of the fishpond will be rehabilitation and improved to become the embankment of the project. Embankment material will be Armour rocks including grouted riprap and geo-textile.

#### **3.4.2.5.2. Installation of Geo-textile Sheet**

Before any dumping is conducted, installation of Geotextile Sheet shall be conducted within the inside portion of the Retaining Wall and Embankments as barrier to avoid seepage from the landfill area. The Geotextile Sheet will be purchased from international sources that guarantee its effectivity for containment of filling materials within the proposed Secured Landfill project and prevent percolation of coal ash materials to the marine waters. The bottom or based portion of the landfill site shall be leveled by filling of limestone. The limestone shall be compacted to attain level or flat elevation of the bottom before installation of HDPE Liner. This strategy will eliminate gaps or space during the placement of HDPE liner to enhance durability.

#### **3.4.2.5.3. Draining of Water Within the Landfill Area**

Water impounded within the proposed landfill area shall be drained using draining equipment (pump). The water will be pumped out from the landfill site to the silt pond prior to final disposal to existing drainage.

#### **3.4.2.5.4. Removal of remaining fauna within the Landfill Area**

The remaining fauna that are trapped inside the retaining walls shall be transferred to area outside the project site.

#### **3.4.2.5.5. Filling of Limestone**

After the remaining seawater is discharged with draining equipment and remaining live fauna is transferred. Filling of limestone materials shall be conducted. Effective spreading equipment shall be used on each lift to obtain uniform thickness prior to compacting. Continuous leveling and manipulating is required to assure uniform density. Water shall be added or removed, if necessary to assure uniform density.

Each layer shall be leveled and smoothed with suitable leveling equipment and by distribution of spalls and finer fragments of limestone.

#### **3.4.2.6. Development for Secured Landfill**

##### **3.4.2.6.1. Installation of Bentonite Clay Lining**

HDPE Liner shall be installed within the flooring of the landfill area as barrier to avoid seepage from the landfill area. The Bentonite clay soil used in the first layer shows plasticity and hardened when dried. It becomes silicate bearing material which are very effective in preventing percolation of coal ash that may sipped into the ground water which may adversely affect the water quality or will assimilate into the sea water eventually polluting the marine ecosystem

##### **3.4.2.6.2. Installation of High Density Polyethelene Sheet (HDPE) Liner**

Right after the Bentonite Clay lining is placed, HDPE liner shall be overlaid over the Bentonite Clay to ensure containment of coal ash.

##### **3.4.2.6.3. Dumping of Coal Ash ( Operation )**

Waste material particularly coal ash from KEPCO Power Plant will be the only waste that will be dumped in the area. An effective method or process of filling coal ash from transportation to dumping shall be implemented by the proponent of the project.

### **3.4.2.7. Construction of Road and Drainage System**

After the backfilling and leveling of the area, it is expected to experience settlements. Because the depth of fill is relatively shallow, only minor settlements are expected. The type of road pavement that will be used is asphalt pavement. There are also portions of the Secured Landfill where fill is very shallow. These areas are those towards the land side of the landfill. In these areas, concrete pavement may be used.

Presently, there is an existing road about 120 meters from the national Highway. However this road is utilized by the community as access from their homes to the National Road so the proponent shall open an all weathered type road located besides the entrance to the CEMEX Port as access for hauling of equipment and materials from source to the Project Site.

The invert elevation of the drainage structures will be positioned to coincide approximately with the highest possible tide. The drainage will be crowned towards the exit points of the drainage system going to Bohol Strait. The road networks will be equipped with closed type reinforced concrete pipe drainage system. Manholes will be placed at regular intervals for easy maintenance. The Drainage System shall have standard catch basins to mitigate run off during rainy days.

#### **Sources of Construction Materials**

Construction Materials for the infrastructures will be sourced out from legitimate suppliers through public bidding.

Construction materials for the construction of Embankments and Retaining Walls shall be purchased through public bidding for national distributors. Filling materials are waste products of the operation of the Power Plant (taken from the coal-combustion by-products, known as "Fly Ash and Bed Ash" that will be generated from the 200megawatt circulating fluidized bed combustion (CFBC) coal-fired power plant managed and owned by the KEPCO SPC Power Corporation (KSPC). The limestone materials will be purchased from legal sources within the region.

### **3.4.2.8. Wastes Associated with Construction**

Construction wastes will come from unused materials during construction of roads and drainage system, excess soil during backfilling and coal ash.

The waste material during filling is the coal ash in which classified as waste material itself. If not carefully managed and properly backfilled within the Secured Landfill area, it may contaminate the coastal area and sea water. It may be also spilled during transport which may cause detrimental impacts to the people and environment. Other waste material generated during the construction phase will be spills of oil and grease from equipment, dusts from filling materials and solid wastes from workers. Proper maintenance of equipment, regular watering of stockpiles and provision of garbage bins shall be implemented all throughout the construction phase.

### **3.4.3. Operation Phase**

The operational phase refers the period during the period of dumping of coal ash. Waste material particularly coal ash from KEPCO Power Plant will be the only waste that will be dumped in the area. An effective method or process of filling coal ash from transportation to dumping shall be implemented by the proponent of the project. Constant spraying of water during dumping of coal ash to the secured landfill. A water truck and personnel shall be assigned for watering during backfilling of coal

ash. Ash unloaded on the landfill facility will be spread throughout the landfill using a dozer or its equivalent. The ash will then be gradually covered with or topped by limestone until each portion of the area is filled up with ash and limestone. The final grade of the Secured Landfill shall be covered with Limestone approximately .6 meters width.

#### **3.4.4. Abandonment Phase**

Abandonment refers to the withdrawal of the equipment used during the filling of the landfill project as well as cleaning of the area for waste materials generated by the workers.

Abandonment is only the beginning of new project considering that after the area is fully filled up, land development shall arise within the area. Proposed projects are already in lined such as the construction of a Port Facility. It is foreseen that the area will be converted into an Economic Zone. Job opportunities and livelihood options will increase in the development of the area as Economic Zone.

#### **3.5. Manpower Requirements for the Construction Phase**

The manpower requirement of the project is estimated to have 95 personnel composed of the following:

Project Engineer	1
Site Engineer	1
Safety Engineer	1
Construction Foreman	2
Truck Drivers	10
Equipment Operators	10
Skilled Workers	20
Semi Skilled/Labor	50

#### **3.6. Project Cost**

The total project cost of the Secured Landfill project is estimated to be **Php 133,000,000.00**

#### **3.7. Project Duration and Schedule**

Project development will start right after all clearances and permits are secured. The project shall have a projected duration of six (6) years of operation. This is based on the capacity of the Secured Landfill.



## 4. BASELINE ENVIRONMENTAL CONDITION

### 4.1. The Land

#### 4.1.1. Geology

Alluvium, Carcar limestone formation, Pandan formation, Ilag formation, Toledo bulacao andesite and Uling formation are types of geologic rocks present in the area.

Alluvium can be found in the coastal plain and river flood plains. Silt, clay, sand and gravel under coastal plain narrow alluvium in borders of most interior streams, beach deposits of sand and coral reefs and some detritus igneous rocks.

The Carcar Limestone formation is typically a porous, coralline poorly bedded or massive limestone. This limestone has an average thickness of about 300 meters and is seldom less than 150 meters thick. Because of its great porosity and favorable position in the geologic column, the carcar formation is noted for its vigorous freshwater springs which provide excellent water supply for numerous communities.

The Pandan Formation flanks the central highlands on the west and concentrate on concentrated on the east side of the Balamban fault. This formation is made up of cretaceous sediments and metamorphosed limestone.

The Ilag Limestone formation generally exhibits a modified haycock topography with vertical cliffs marking its margins. This formation is said to be coal-bearing.

The Toledo Formation is found in low rolling hills and gentle shales broad V-shaped valleys. This formation is composed of white bentonitic shales underlain by brown carbonaceous shales locally coal bearing; all with limestone.

The Bulacao Andesite is folded and faulted monoclinical component of a once extensive dome. It is typically perphyritic and generally brecciated in texture. Andesite plagioclase, brown or brownish green hornblends, augites and hypersthene constitutes the phenocrysts which are set in glassy microlitic groundmass. Zoned plagioclase crystals usually contain abundant vacuoles and brown inclusions. The hornblends has small extension angles and seems to approach the basaltic type of hornblend in optical properties.

The Uling Limestone formation occurs mainly as widely scattered ventricular bodies along the principal fault zones of Central Cebu.

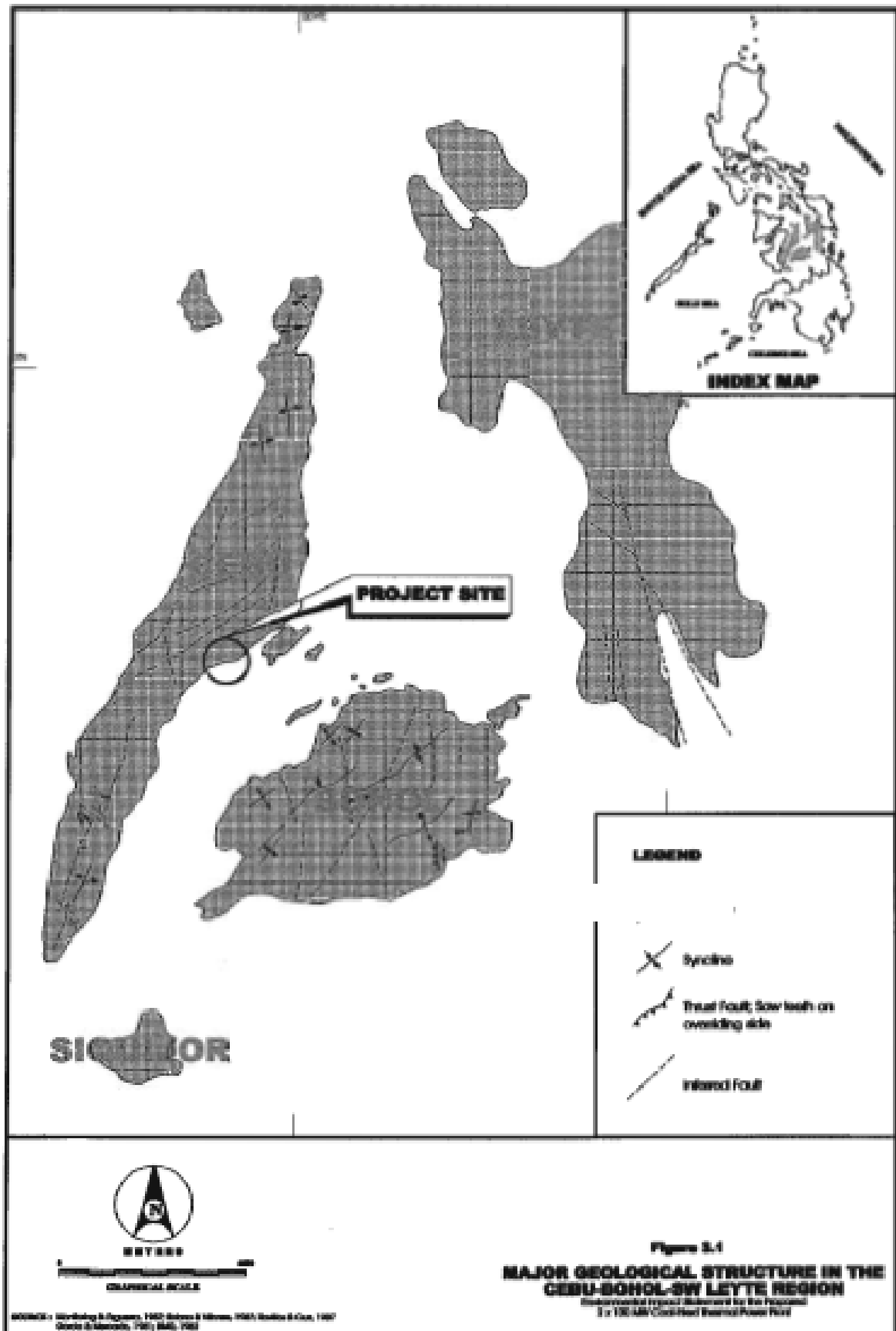


Figure 2. Major Geological Structure in the Cebu-Bohol-SW Leyte Region

#### 4.1.2. Erosion Potential

With a terrain predominantly hilly and mountainous, most areas in the Municipality are severely susceptible to erosion covering 48.077% of the whole land area. The following table shows the erosion susceptibility classification:

Table 2. Erosion Potential of Naga

DESCRIPTION	AREA (HA.)	%TO TOTAL AREA
Not susceptible to erosion	1,193.1554	12.832
Slightly susceptible	891.9723	9.593
Moderately susceptible	2,446.2777	26.310
Severely susceptible	4,470.3086	48.077
Unclassified	296.5378	3,189
Total	9,298.2400	100.00

The lowland areas are relatively slightly susceptible to erosion. The upland areas are moderately to severely susceptible to erosion.



Figure 3. Erosion Map of Naga, Cebu ( Source: CLUP, Naga 1996-2005 )

#### **4.1.3.Tectonics**

The Philippine Archipelago is in a dynamic setting of the convergence of the Pacific and Philippine Sea Plates from the east and of the Continental Eurasian and Indo-Australian Plates from the west and southwest of the Proto-Philippine Island Arc or the Philippine Mobile Belt. These zones of convergence are marked on the surface by oceanic trenches, mountain ranges and volcanic belts, where high incidence of seismic and volcanic activities are occurring. Regional deformation is accommodated by subduction along major trench systems, like the Philippine and Manila trenches as well as movement along regional fault system such as the 1200 km long Philippine Fault System.

#### **4.1.4.Local Terrain**

The City of Naga is relative hilly with slopes 8% to 18%, while the lowland areas along the coastline where the project is located are characteristically flat but undulated with 0%-8% slope, towards the inland areas increases in slope from hilly to mountainous from 18% to 50%.

Based on the slope classification those areas having slopes of 18% and above are classified as public or forest land, whereas those having slopes of below 18% are classified as Alienable and Disposable (A & D) lands areas having 0-18% slope comprise 23.829% of the total land area of NAGA. Thus, the lowland areas are relatively slightly susceptible to erosion, whereas the upland areas are moderately to severely susceptible to erosion.

#### **4.1.5.Seismicity**

The Philippine Archipelago is one of the world's most tectonically and seismically active areas. Most earthquakes are generated along active faults (fracture or breaks) in the earth's crust. Plate tectonic movements generate opposing movement of crustal plates or fault walls from each other that become jammed due to friction. As opposing walls break from each other elastic waves are emitted or energy is released measurable in terms of Magnitude Scale defined in Richter scale units.

#### **4.1.6.Lithology/Stratigraphy**

The pre-Cretaceous basement rock in Cebu is represented by the metamorphic Jurassic Tunlob Schist consisting of chlorite, mica and amphibolite. Cretaceous ophiolites rock suites and the Mananga Group with intertonguing units of Early Cretaceous Cansi Volcanic consisting of massive flows, breccias and pillow-lavas that overlie the Jurassic Tunlob Schist.

Unconformably overlying the older Cretaceous rocks are the Tertiary Paleocene Eocene, Oligocene, Miocene and Pliocene Sedimentary Formations consisting of Paleocene Pandan Formation comprised of shallow-marine sediments and limestone with intercalated volcanic flows, Eocene-BAye Formation, Early Oligocene-Lutak Hill Formation and Late Oligocene Cebu Formation, Early-Miocene Malubog/Linut-od Formation, Middle-Miocene Toledo Formation and Bulacao Andesite and Late Miocene Maingit Formations with Talamban Diorite Peridotite; and Pliocene-Barili Formation with limestone; and Quaternary Pleistocene Carcar Formation with Limestone, and Quaternary Holocene Alluvium.

Resurgences of island arc volcanism are indicated by the extrusion of the Bulacao Andesite and intrusions of the Talamban, Bulacao, and Lutopan intrusions and volcanics. Subsequent emergence and submergence of the Visayan Sea basin is indicated by the series of deposition and erosion of the sedimentary rock formations during Tertiary Era to Pleistocene Epoch. Recent and Quaternary Alluvium are distributed in the coastal, deltaic and alluvial plains and riverbeds.

#### 4.1.7 Pedology

Soil composition in the area is of five types, namely: Faraon Clay, Lugo Clay, Faraon Clay Steep Phase, Mandaue Clay loam and Baguio clay loam. Predominant is faraon clay steep phase which comprises 39.36% of the total land area.

Faraon Clay - This type of soil is usually found in areas with undulating to hilly slope. The principal distinguishing characteristics of this type is its black heavy clay soils with outcrops of gray, coralline and porous limestone. The surface is littered with pebbles and cobbles of limestone. This soil remains moderately friable and maintains its excellent good structure when dry. Those areas with this type of soil are widely planted with coconut, corn, cassava, banana, and fruit trees.

Faraon clay steep phase – Areas having this type of soil are located mostly in steep hills and mountains.

Lugo clay – This type is a residual soil developed from lime and shale, suited to the growing of sugarcane, coconut, tobacco, banana, etc.

Mandaue Clay – The surface soil of this type is light brown to dark depending upon the amount of organic matter and moisture content. It is friable when just moist, thick, sticky and soft when wet and hard when dry. The substratum is made up of compact clay loam.

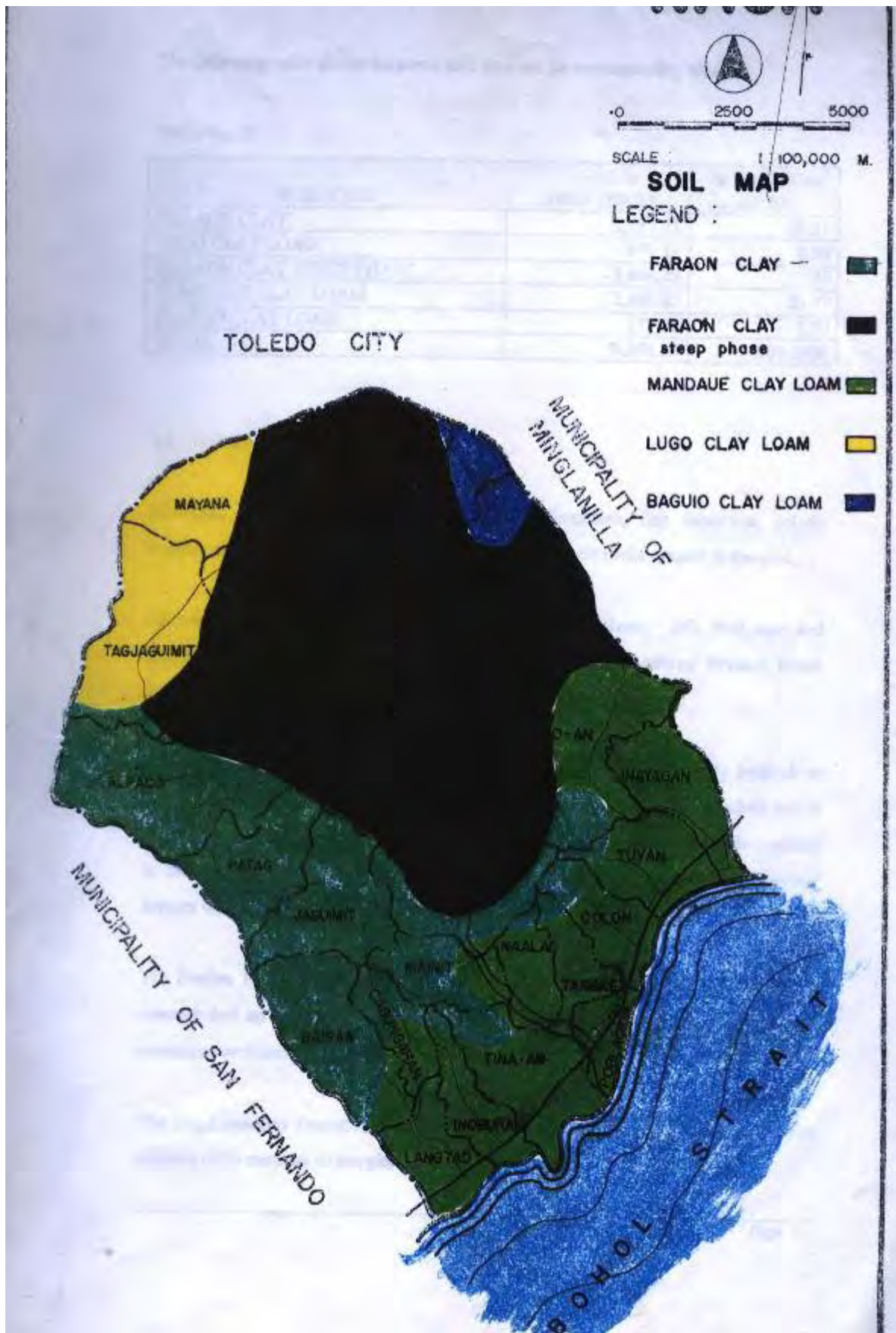


Figure 4. Soil Map of Naga, Cebu( Source: CLUP, Naga 1996-2005 )

## 4.1.8 Terrestrial Biology

### Existing Vegetative Cover

The site is located in an industrial area. The presence of the terrestrial Flora in the area is confined within the land portion of the project. The site is dominated with Coconuts, Fruit Trees and Ornamental Plants. There is no endangered species present in the area.

### Existing Wildlife Species

Wildlife such as birds, reptiles and amphibians are present. The most common is the Eurasian tree sparrow and frogs.

## 4.2. The Water

### 4.2.1 Hydrology and Hydrogeology

The vicinity of the project site consists of mountain ranges on the western side while on the opposite eastern side is the Bohol Strait. The mountain ranges have an elevation of around 120 meters above mean sea level and define the watershed of vicinity of the power plant. Runoff water flows down from the mountain bringing loose soils and gravel material from the mountain areas, and via existing gullies, discharges into the coastal areas.

### 4.2.2. Water Quality

The physico-chemical characteristics of water are important factors to determine the quality of the coastal environment. The investigation of the water quality utilizes the study conducted by Test Consultants, Inc. during the conduct of EIA within Naga, Cebu for the Coal Fired Power Plant.

The study considers the following parameters, such as: salinity, temperature, turbidity, potential hydrogen (pH), dissolved oxygen (DO), biological oxygen demand (BOD), sulfite, nitrite and phosphate.

Parameters	Marine Station Number					DENR Standard (DAO 34)
	01	02	03	04	05	
Temperature (°C)	32	31	34	38	31	>3° of ambient temp.
Salinity (‰)	30	32	30	29	32	
pH	8.4	8.5	8.6	8.5	8.5	6.5-8.5
Turbidity (NTU)	9.11	6.15	8.03	6.07	5.97	
Light Visibility Index (m)	6	4	4	6	3	
Dissolved Oxygen (mg/L)	2	2	2	2	2	70
Total Coliform Count (MPN/100ml)	23	<2	1,600	240	<2	5,000
TSS (mg/L)	<2	4	4	4	2	30
BOD (mg/L)	<1					7-10
COD (mg/L)	1,030	192	1,242	951	784	
Color (PCU)	<5	<5	<5	<5	<5	
Oil and Grease (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1	3
Cyanide (mg/L)	<0.002	<0.002	<0.002	<0.002	<0.002	0.05
Arsenic (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1	0.05
Chromium, BI (mg/L)	<0.003	<0.003	<0.003	<0.003	<0.003	0.1
Lead (mg/L)	0.17	0.15	0.15	0.15	0.10	0.05
Mercury (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001	0.002
Nitrate/Nitrite (mg N/L)	0.41	0.83	0.13	1.51	0.087	
Phosphate (mg P/L)	2.4×10 <sup>-3</sup>	1.9×10 <sup>-3</sup>	2.8×10 <sup>-3</sup>	6.4×10 <sup>-3</sup>	1.8×10 <sup>-3</sup>	



Result of the study reveals that the water quality in the area is compared with the standards range set by the Department of Environment and Natural Resources (DENR) standards.

### **Temperature**

Temperature is the measurement of the intensity of heat rather than the quantity of heat. Its importance lies on the fact that it affects a broad spectrum of biological, physical and chemical processes which in turn affects the distribution of organisms, the density of the water and the solubility of minerals and gases in the environment. It is most critical in the tropical regions where organisms live at temperatures only a few degrees below their upper lethal limit (Mayer, 1914).

The samples collected during the sampling yielded slightly higher temperature ranging from 31° C to 34° C as compared to generally accepted temperature range of 28°C to 30° C at the surface fro seawaters in the tropical region.

### **Salinity**

Seawater in solution is complicated and contains the majority of the known chemical elements. The more abundant component is chlorine ions which composed approximately 55% of the total dissolved material. Its significant feature is that while the total concentration of dissolved salts varies from place to place, the ratios of the more abundant components remain almost constant. The total amount of dissolved material in seawater is termed the *salinity* and has been defined as “the total amount of solid materials in grams contained in one kilogram of seawater when all the carbonate has been converted to oxide, the bromine and iodine replaced by chlorine and all organic matter completely oxidized. The average salinity of seawater is about 35 grams of salt per kilogram of seawater and expressed as  $S = 35‰$ .

Salinity measurements levels ranging from 29% to 32% which was a little below the average salinity in the open sea was tested during the sampling.

### **pH**

pH is a system of notation to express hydrogen ion concentration as proposed by Sorensen. Hydrogen ion concentration is expressed in terms of negative logarithms and such values designated as “Power or Potential of Hydrogen” or plainly pH. The pH scale is usually represented as ranging from 0 to 14 with pH 7 as point of neutrality and below 7 as acidic while above 7 as basic. The farther the pH value is from the neutral value of 7, the greater is the concentration of either  $[H^+]$  or  $[OH^-]$  ions.

Seawater is slightly basic in nature and pH readings taken from the sample stations are consistent with this principle. pH values taken from the different sampling stations ranges from pH 8.4 to pH 8.6 and is very much within the average open seawater pH of 8.5

### **Turbidity**

Turbidity is an expression of the optical property of water, which causes light to scattered and absorbed, rather than of being transmitted in straight lines throughout the water column. Most causes turbidity are due to the presence of suspended matter such as clay, silt, fine organic or inorganic matter and microorganisms.

The degree of water turbidity affects the amount of sunlight that can penetrate through the water column and may therefore be a limiting factor of photosynthesis of marine plants.

The level of turbidity as determined from the samples collected and analyzed is very low and well within the turbidity range units of 1-10 with the highest turbidity value read at 9.11 mg/L and the lowest is at 5.97 mg/L.

### **Dissolved Oxygen**

The amount of dissolved oxygen affects directly the aquatic life especially those dependent on aerobic respiratory reactions for energy production needed for growth. Dissolved oxygen in water also determines the capacity of the water to receive organic wastes without causing nuisance or killing aquatic life.

Dissolved oxygen in the seawaters of the sampling sites was determined at 2 mg/L at all sampling stations and is indicative of a slightly anoxic condition of these waters that may have detrimental effects on aquatic life, especially those with very sort tolerance to available dissolved oxygen in water.

### **Total Coliform Count**

The significance of coliform group densities has been established as a good criteria of the degree of pollution or contamination and this the sanitary quality of the body of water. The amount of coliform densities obtained from the multiple tube fermentation test is usually reported in terms of Most Probable Number (MPN) Index, which is simply an index of the number of coliform organisms more probable than any other number that could be obtained through laboratory examination and is not an actual count of the organisms found in the sample.

All samples but one taken from the different sampling stations were found to be well below the required level of tolerated quantity of coliform for Class SC waters. High level of coliform count in front of the city drainage is quite understandable as that particular part is immediate recipient of wastewater and other sewage of the residents nearby.

### **Nitrate/Nitrite**

Analysis of nitrogen in various forms may therefore serve as basis of judging sanitary quality of water. Presence of high organic nitrogen in the water column means the presence of a lot of organic material that could exert oxygen demand. High concentration of ammonia and nitrite means that anaerobic or reducing condition predominates in the water. A large cam easily be assimilated by algae and other aquatic plants. This may lead to heavy algal growth leading to eutrophication though it seldom occurs in open sea waters because of its dynamic nature but may occur in sheltered bays and coves where water exchange is not as dynamic as in the open sea.

Nitrate and Nitrite concentration in Naga is considered very low and well within the tolerable limits for Class SC Waters.

### **Phosphates**

Phosphates play an important role in biological metabolisms as source of ATP for bioenergetics, phosphates in salt that serve as structural materials and as important constituents of nucleotides. The amount of phosphate in natural waters is usually limited although domestic sewage and waste containing detergents may increase phosphate concentration. The amount of phosphate detected from samples taken in the area showed traces of phosphates considered as regular and normal at any given period of time and therefore is well within the limits defined for Class SC Waters.

*Note: Water sampling and analysis for water quality of waters within the proposed Secured Landfill site was initiated and results are attached. (Please see laboratory results from Technolab)*

#### **4.2.3. Coastal Erosion and Sedimentation**

The wave/wind directions and the wind wave intensity are the primary parameters affecting sediment transport. With regards to sediment movements, two distinct zones are considered: the surf zone and the offshore zone. Within the surf zone, the long shore component of the surge force causes the formation of the littoral drift or current.

Though the input energy may vary, the direction and velocity of littoral currents can reasonably remain steady for some time. Due to the turbulence of breaking and surging of waves, large volumes of sediments are placed in suspension or pushed along the bed within the surf zone. The active littoral currents act on this suspended particles and carry them along the shore and deposit them in other places.

Along the eastern edge of Cebu Island, the coastal erosion processes normally disturb the beach in the months when the wind and waves are against it. These are in the months of July to October. The rest of the year, the other side of Cebu Island, the western edge, will have its turn for the coastal disturbances since the wind and waves direction will be blowing toward the northeastern direction.

#### **4.2.4. Oceanography**

Oceanographic conditions in coastal waters differ in many respects from those of the open sea. Factors include the presence of the coast as a boundary to flow, the shallowness of the water over the continental shelf, river runoff and precipitation, and the effects of continental air masses flowing over the sea. All these factors influence coastal water movement and variations of water properties and motion with position and with time are larger than is generally the case in the open ocean. The shoreline as a boundary limits possible directions of motion so that horizontal flow tends to parallel the coast.

Recognizing this effect is important because it represents one of the few situations in which man can exert significant influence on the ocean through the construction of jetties and breakwaters for shipping and shoreline protection.

It is of common observation that the construction of shoreline impediments to natural water movement has often led to unexpected changes like the deposition of silt and the formation of new shoals, or the removal of beaches and scouring of land when a jetty prevented the longshore movement of sand required to maintain a beach whose material was being eroded by wave action.

#### **4.2.5. Bathymetry**

Available coast and geodetic map showed that the immediate fringe of the subtidal area of the cove ranges in depths of 5 to 10 meters and gradually deepens as it approaches the center of the cove down to the open sea. ( source : EIS for the proposed 2 x 100 MW Coal Fired Thermal Power Plant Project, Naga, Cebu )

#### **4.2.6. Tides**

Less obvious and usually taken in naturally is the effect of the coast in causing vertical motions of the water. One of these is the vertical motion called tide, the semidiurnal or diurnal rise and fall of sea level due to the coast blocking the horizontal flows generated by the periodically varying astronomical forces and causing the water to pile up against the coast during flood tide or fall away during ebb tide.

Surface tides near the mainland and along the coast in the tropical regions are typical of continental shelf areas, with diurnal, semi-diurnal and longer-period constituents. Most are solar in character with high waters at noon and midnight and low waters in the early morning and late afternoon.

#### 4.2.7. Marine Biology

Secondary data was utilized for the determination of the different marine species present within the coastal areas of City of Naga. This data was taken from the previous EIA of KEPCO Philippines done in 2005. Due to proximity of the study areas to the project site, the species are likely the same except for the Mangrove Forest which have dominant species within the coastal area of Brgy. Tinaan.

#### Corals, Algae and Seagrass Communities

Algae are primary producers of the marine environment. There are three major groups based on their dominant colors: Chlorophyta (green algae), Phaeophyta (brown algae) and Rhodophyta (red algae). Naga has sandy shore and intertidal belt that gradually slopes down into the Bohol Strait. In this area only soft bottom community can be found, especially the ephemeral species of seagrass ( *Halodule pinifolia* ) and green algae ( *Enteromorpha intestinalis* and *E. clathrata* ).

List of algae and seagrass that can be found within Naga

##### Chlorophyta (Green Algae)

- 1) *Anadyomene plicata*
- 2) *Boergesenia foresii*
- 3) *Boodlea composite*
- 4) *Bornetella nitida*
- 5) *B. sphaetrica*
- 6) *Caulerpa racemosa*
- 7) *C. serrulata*
- 8) *Codium arabicum*
- 9) *C. tomentosum*
- 10) *Enteromorpha clathrata*
- 11) *E. intestinalis*
- 12) *Halimeda macroloba*
- 13) *H. macrophyta*
- 14) *H. opuntia*
- 15) *H. simulans*
- 16) *H. tuna*
- 17) *Neomeris vanbosseae*
- 18) *Spongomorpha sp.*
- 19) *Udotea sp.*
- 20) *Ventricana ventricosa*

##### Phaeophyta ( Brown Algae )

- 21) *Colpomenia sinuosa*
- 22) *Dictyota friabilis*
- 23) *D. dichotoma*
- 24) *Dictyopteris repens*
- 25) *Dictyosphaeria cavernosa*
- 26) *Hormophysa cuneiformis*
- 27) *Lobophora variegata*
- 28) *Padina spp*
- 29) *Pockockielia variegatum*
- 30) *Sargassum spp*
- 31) *Turbinaria conoides*
- 32) *Turbinaria ornata*

#### Rhodophyta ( Red Algae )

- 33) *Acanthophora spicifera*
- 34) *Actinotrichia fragilis*
- 35) *Amansia glomerata*
- 36) *Amphiroa foliacea*
- 37) *Amphiroa fragilissima*
- 38) *Eucheuma gelatinae*
- 39) *Carpopeltis sp.*
- 40) *Galaxaura fasciculata*
- 41) *Galaxaura oblongata*
- 42) *Gelidiella acerosa*
- 43) *Gelidium sp.*
- 44) *Gracilaria coronopifolia*
- 45) *Gracilaria eucheumoides*
- 46) *Gracilaria salicornia*
- 47) *Halymenia durvillaei*
- 48) *H. maculate*
- 49) *Hypnea musciformis*
- 50) *H. pannosa*
- 51) *Jania spp* *Laurencia sp*
- 52) *Tinanophora weberae*

#### Anthrophyta ( Seagrasses)

- 1) *Cymodocea rotundata*
- 2) *Halodule pinifolia*
- 3) *Halodule uninervis*
- 4) *Halophila ovata*

#### **Mangroves**

Mangrove is an ecosystem dominated by mangrove trees as primary producers interacting with associated aquatic and terrestrial fauna, social and physical factors of the coastal environment. The mangrove composition located in Barangay Tinaan comprises of five species belonging to three families. About 2.19 hectares of mangrove forest can be observed as part of the titled property of the province. This mangrove forest will not be included in the Secured Landfill project.

List of Mangroves found in Brgy. Tinaan

##### Family Rhizophoraceae

- 1) *Rhizophora apiculata*
- 2) *Rhizophora Stylosa*

##### Family Avicenniaceae

- 3) *Avicennia marina*
- 4) *Avicennia lanata*

##### Family Sonneratiaceae

- 5) *Sonneratia Alba*

## MacroInvertebrates

A listing of marine invertebrates within the coastal area of Naga. A list of species is presented below:

List of Invertebrate species found

### Echinoderms

- 1) *Linkia spp*
- 2) *Bohacishia graffeii*
- 3) *Acanthaster plancii*
- 4) *Comanthus sp*
- 5) *Culcita sp*
- 6) *Diamema setosum*
- 7) *Echinocardium cardatum*
- 8) *Echinometra mathaeii*
- 9) *Echinotrix calamares*
- 10) *Malleus sp*
- 11) *Ophiorachna incrassate*

### Tunicates

- 12) *Didemnum molle*
- 13) *Polycarpa aurata*
- 14) *Rhophallea sp*

### Mollusks

- 15) *Spondylus sp.*
- 16) *Malleus malleus*
- 17) *Tridacna sp*
- 18) *Conus sp*
- 19) *Cyprea sp*
- 20) *Lambis so*
- 21) *Nerita sp*
- 22) *Anadara maculate*
- 23) *Lambis sp*
- 24) *Murex sp*
- 25) *Tridacna crocea*
- 26) *Tronchus sp*

### Sponges

- 27) Orange barrel
- 28) Orange red encrusting
- 29) Brown encrusting
- 30) Elephant ear
- 31) Gray barrel
- 32) Corrugated brown
- 33) Foraminiferans

### Crustaceans

- 34) *Blue Soldier Crab*

### Jelly Fish

- 35) *Mastigias papua*
- 36) *Netrostoma*

## Corals

A total of 32 corals were identified within the reefs of Naga.

List of corals found in Naga

- 1) *Acropora*
- 2) *Cyphastrea*
- 3) *Diploastrea*
- 4) *Echinopora*
- 5) *Euphyllia*
- 6) *Favia*
- 7) *Favites*
- 8) *Fungia*
- 9) *Galaxea*
- 10) *Goniastrea*
- 11) *Goniopora*
- 12) *Heliofungia*
- 13) *Herpo;itha*
- 14) *Hydnophora*
- 15) *Lobophyllia*
- 16) *Merulina*
- 17) *Montipora*
- 18) *Oxypora*
- 19) *Pachyseris*
- 20) *Pavona*
- 21) *Pectinia*
- 22) *Physogyra*
- 23) *Pterogyra*
- 24) *Podabacia*
- 25) *Porites*
- 26) *Pocillopora*
- 27) *Seriatopora*
- 28) *Stylophora*
- 29) *Symphyllia*
- 30) *Turbinaria*
- 31) *Heliopora*
- 32) *Millepora*

## Fishes

A total of 27 species of fishes are found within the shores near Apo Cement, Naga, Cebu.

List of Fishes found near Apo Cement

Family Pomacentridae

- 1) *Abudefduf sexfasciatus*
- 2) *Pomacentrus brachialis*
- 3) *Pomacentrus burroughi*
- 4) *Pomacentrus coelestis*
- 5) *Pomacentrus grammorhyncus*
- 6) *Chrisiptera unimaculatus*
- 7) *Dascyllus aruanus*
- 8) *Pomacentrus moluccensis*
- 9) *Pomacentrus vaiuli*

Family Apogonidae

10) *Apogon lineatus*

Family Tetraodonthidae

11) *Arothron sp.*

Family Labridae

12) *Chellinus chlorourus*

13) *Halichoeres argus*

14) *Halichoeres biocellatus*

15) *Halichoeres nebulosus*

16) *Halichoeres scapulari*

17) *Stethojulis bandanensis*

18) *Thalassoma lunare*

19) *Cheilio sp*

20) *Hemigymnus melapterus*

Family Lutjanidae

21) *Lutjanus decussates*

Family Pinguipidae

22) *Parapercis cylindrical*

Family Mullidae

23) *Parupeneus barberinus*

24) *Parupeneus bifasciatus*

Family Scaridae

25) *Scarus sordidus*

26) *Calostomus sp.*

Family Chaetodontidae

27) *Chaetodon octofaciatus*

#### **4.3. The Air**

##### **4.3.1 Temperature and Relative Humidity**

Temperature is relatively constant throughout the year with daily fluctuation of 7°C. The easterly trade winds bring warm dry air. Please see attached climatological normals. The weather is relatively moderate and is endowed with a tropical climate. Humidity is 78%, warmest temperature usually occurs during the months of December to February, and wet seasons are expected during November. Mean temperature range is from 19.2°C-36.4°C.

Rainfall on the island can occur every month, but the wettest months are October, November and December. Average annual rainfall is 28.1 mm per year and the annual rainfall is 1,638.20 mm. The minimum monthly rainfall is 23.9 mm. and the maximum monthly rainfall is 32.8 mm.,



Table 1. Cebu PAGASA Complex Climatological Temperature Normals. (1993-2002) 10 Years Period.

MONTH	Rainfall			Temperature °C		MEAN RELATIVE HUMIDITY (%)	MEAN CLOUDINESS (0-8)
	MEAN	MEAN MAX	MEAN MIN	HIGHEST RECORDED	LOWEST RECORDED		
JAN	26.9	29.9	23.9	34.5	19.2	81	6
FEB	27.1	30.2	24.0	33.4	20.0	79	6
MAR	27.7	31.1	24.3	33.6	21.5	77	5
APR	28.8	32.2	25.3	35.4	22.2	75	5
MAY	29.3	32.8	26.0	36.4	22.3	75	5
JUN	28.7	32.1	25.2	35.7	21.4	79	7
JUL	28.3	31.7	24.8	35.3	22.0	80	7
AUG	28.5	31.9	25.0	34.8	21.1	79	7
SEPT	28.4	31.8	25.0	34.6	21.8	80	7
OCT	28.1	31.4	24.8	34.2	21.6	82	7
NOV	27.8	31.0	24.6	33.8	22.4	82	6
DEC	27.2	30.1	24.2	33.1	20.5	82	6
ANNUAL	28.1	31.4	24.8	36.4	19.2	79	6

#### 4.3.2. Meteorology

The project site is characterized by the PAGASA as the third type of climate in which is characterized with no distinct wet and dry season. This is predominant throughout the whole province of Cebu. The summer heat, which generally comes in March, reaches its peak in April and May. There is more rainfall in the southeast monsoon season in September. The climate is characterized by a uniform high temperature and heavy precipitation uniformly-distributed throughout the year with the average annual rainfall of 1,638.20 mm. The driest month is April and the heaviest rainfall is experienced around October.

Table 2. Average Rainfall data in Mactan Station for CY 2006 (PAGASA, 2006)

Month	Average	Greatest
January	82.1	146.7
February	88.1	226.5
March	59.5	145.0
April	24.0	54.1
May	124.9	228.9
June	195.4	339.7
July	186.2	381.7
August	137.2	218.0
September	208.9	326.9
October	230.4	258.1
November	157.2	339.6
December	207.8	330.1

#### 4.3.3. Occurrence of Typhoon

The Philippines is visited yearly by approximately 22 typhoons. Typhoons are very strong storms with wind velocities of two to three hundred kilometers per hour. Cebu is situated on 10 degrees North, which means the southern edge of typhoon belt. Typhoons therefore hit the island only very seldom, statistically once in every forty years. The last strong typhoon that hit the island was typhoon "Ruping" in November 1991. This typhoon hit the island with winds of 325 kilometers per hour. Damage was extensive, but loss of life was limited. The typhoon season is from May to December.

#### 4.3.4. Air Quality and Noise

Only exhaust from the passing vehicles near the site contributes air pollution to the area. Other source of pollution is APO Cement but this is already mitigated by the management of APO Cement. This slight polluted air is immediately dissipated by unobstructed normal wind current from the open sea.

The area being located along the coast, with fair distance from the city's congested streets. Noise from the daily activities of the residents and the passing vehicles can be heard.

### 4.4. The People

#### 4.4.1 Profile of City of Naga

Naga is located in the southeastern part of the province of Cebu. It is 22 kilometers away from Cebu City, the capital of the province. Naga has a total land area of 9, 298.45 hectares comprising of 28 barangays. The Urban land area encompasses 494 hectares or roughly 5% of the total land area. The urban comprises Brgys. Central, East, North, South and West Poblacion and Brgys. Tinaan, Langtad, Inoburan, Colon, Tuyan and Inayagan. The rural areas comprises 95% of the land area of the municipality.

#### 4.4.2. Population and Growth Rate

The municipality has a current population of 95,163 based on the NSO August 1, 2007 census.

Table 3. Total population of Naga per Barangay, August 1, 2007

<b>CITY OF NAGA <sup>3</sup></b>	<b>95,163</b>
Alfaco	2,584
Bairan	1,681
Balirong	3,551
Cabungahan	1,110
Cantao-an	4,842
Central Poblacion	1,012
Cogon	2,943
Colon	3,865
East Poblacion	529
Inoburan	4,339
Inayagan	7,525
Jaguimit	1,760
Lanas	2,455
Langtad	5,771
Lutac	3,535
Mainit	2,488
Mayana	863
Naalad	2,397
North Poblacion	2,665
Pangdan	4,502
Patag	1,109
South Poblacion	4,089
Tagjaguimit	2,437
Tangke	4,458
Tinaan	6,045
Tuyan	9,283
Uling	4,351
West Poblacion	2,974

#### 4.4.3. Health

The primary unit that delivers health care services to the people of Naga are the two Rural Health Units (RHUs) and its respective Barangay Health Stations (BHS).

The RHU I, with its main health center located in Brgy. Tina-an, covers the following barangays: South Poblacion, Central Poblacion, West Poblacion, Tina-an, Inoburan, Langtad, Bairan, Cabungahan, Lutac, Alfaco, Lanao, Balirong, Uling, Tagjaguimit and Mayana.

The RHU II, with its main health center located in Central Poblacion covers the following barangays: East and North Poblacion, Tangke, Tuyan, Inayagan, Cantao-an, Cogon, Colon, Naalad, Mainit, Pangdan, Jaguimit and Patag.

Aside from the RHUs, which is government-run, there is one hospital, two medical clinics and two dental clinics which privately provide health services to the people.

The POA Cement Corporation hospital located in Brgy. Tina-an, services the health care needs of the company's staff and employees. The medical and dental clinics located in the Poblacion, services patients for a fee.

In most emergency cases, referrals is made to nearby Minglanilla District Hospital or to Don V. Sotto Memorial Hospital in Cebu City.

The main health centers of the RHUs render a broad range of services, covering mostly referrals from the BHS and the preventive, promotive and curative aspects of health care. It delivers primary health care through the following programs:

- Maternal and Child Health Care
- Expanded Program on Immunization
- Acute Respiratory Immunization
- National Tuberculosis Disease Control Program
- Control of Diarrheal Disease
- Cancer Control Program
- Environmental Sanitation Program
- Targeted Food Assistance Program
- Cardio Control/Cardio Vascular Disease Program

The BHS is the initial unit that dispenses basic health care. It renders the following services: Prenatal and birth delivery assistance to mothers, vaccination, referrals and environmental sanitation. There are twenty-four BHS located in twenty-four different barangays.

Table 4. The leading causes of mortality, average in the past 5 years and 1994 are shown in the following table:

LEADING CAUSES	Average Past 5 Years		1994	
	No.	Rate	No.	Rate
<b>A. RHU I</b>				
1. Pneumonia	30	99	85	109
2. Coronary Heart Disease	18	59	14	43.6
3. Arteriosclerosis	8	26	10	81.1
4. Septicemia	14	46	8	24.9
5. Hypertension	15	49	8	24.9
6. Anemia	12	39	8	24.9
7. Medico-Legal cases	4	13	6	18.6
8. Malignancies	3	10	5	15.5
9. PTB	8	26	4	12.46
10. Meningitis	6	20	3	9.3
<b>B. RHU II</b>				
1. Gen. Arteriosclerosis	14	44.2	19	57.9
2. Cancer	7	16.9	6	18.3
3. CVA	8	17.25	5	15.2
4. Pneumonia	9	30.4	5	15.2
5. Congenital Heart Disease	2	4.7	3	9.2
6. Gastroenteritis	2	4.7	3	9.2
7. PTB	2	4.7	2	6.1
8. Acute Myocardial Infarction	1	2.5	2	6.1
9. Septicemia	1	2.5	2	6.1
10. Liver Cirrhosis	3	8.8	2	6.1

Pneumonia, arteriosclerosis, heart disease, cancer were the leading causes of the two RHUs. The prevalence of these diseases is typically common to industrialized and urbanized areas which the city is becoming. Industrialization and urbanization relate to the following-pollution, stress, poor health habits, etc.

Although, on the average, there was a decrease in the number of incidence, development trend towards full industrialization and urbanization, indicates an upsurge of these disease if prevention and control is not vigorously pursued.

Prevention and control requires the involvement of the community and the people's awareness on various aspect of health care and environmental sanitation. Trainings, seminars, creation of community/barangay health boards and the community's participation in health programs and projects would greatly enhance the peoples knowledge and raise their level of awareness on the importance of healthy community, environment and well-being of each person.

#### 4.4.4. Education

The Department of Education, Culture and Sport (DECS), provides elementary education through its two school districts – District I and II. District I has ten elementary schools, while District II has eleven.

There are four government and one private secondary schools within the City of Naga namely: Balirong National High School, Langtad National High School, Don Canonigo High School, Tuyan National High School and Siena School of Naga.

#### 4.4.5. Sports and Recreation

The youth are the most active in sports and majority of them preferred the game of basketball, which incidentally is the most popular sport in the country. Basketball courts can

be found in almost all of the barangays be it paved with gravel, packed earth or concrete. The basketball courts in the barangays are also called a multi-purpose pavement – since it is being utilized as venue of various barangay activities.

Less popular sports (volleyball and other ballgames, field and indoor events) are only played during the Department of Education Culture and Sports (DECS) sanctioned athletic events which are seldom held. However, basketball tournaments are held in most part of the year.

#### **4.4.6. Forestry**

The total land area of Naga is 9,298.24 hectares. Out of this total, 6,864.0734 hectares of 73.82% are located in 18% slope and above. It should be noted that “ no land of the public domain 18% in slope or over shall be classified as alienable and disposable land nor forestlands 50% slope or over shall be classified as grazing land”.

Based on this restriction, only 26.18% of the total land area of Naga can be classified as Alienable and Disposable land. A rapid scanning of the municipality revealed that there are human instructions on forestlands especially in Barangays Cogon, Ianas, Mayana, Tangke and Colon.

#### **4.4.7. Power**

The NPC powered Visayan Electric Company, Inc. (VECO) is supplying Naga with electric power. At present, the 28 barangays of the municipality has been served by electricity with exception of some sitios in some barangays due to inaccessibility and widely dispersed households (low density). The development was made possible through the DOE's (ERI – 94) electrification fund.

Out of the total number of households, 68.9% or 10,898 households are using electricity as their source of lighting. Kerosene comes in second with 28% or 4,421 households. Other lighting sources are LPG, oil and others.

Wood is the primary source of cooking fuel accounting for 54.6% or 8,637 household. Second is liquefied petroleum accounting for 29.2% of the total household.

#### **4.4.8. Protective Services**

The local police department is in-charge in the delivery of protective services to the people and the maintenance of peace and order in the community. The prevailing peace and order situation is considered normal as far as law enforcement is concerned.

Crime against person and crimes against property were the most common for the past three years

#### **4.4.9. Public Consultation**

The Provincial Government of Cebu through its Provincial Planning and Development Office conducted Public Consultation through interviews towards their views and questions pertaining to the proposed Project and soon as an Economic Zone area within the 24.6817 hectares site within Brgy. Tinaan. The PPDO also consulted with the mayor and barangay officials. Please see attached summary in Annex

## 5. IMPACT ASSESSMENT AND MITIGATION

Each of the impacts identified were assessed and evaluated using a set of criteria. The set of criteria was used to determine which impacts are the most or least significant. Criteria used in the study are nature of the impact, reversibility of the impact, magnitude of the impact, duration of impact, and the identification of mitigating or enhancement measures to address the impact. Nature refers to whether an identified impact is positive or negative, reversibility refers to whether an impact is reversible or not, magnitude on the other hand, refers to whether an impact is insignificant, moderate or severe, while duration refers to the time period that the impact would occur, whether it is short or long term.

### 5.1. Phases of Development

#### 5.1.2. Construction Phase

##### 5.1.2.1. Ecological Impacts

###### Potential Impacts Associated with Marine Ecology and Water Quality

There will be negative impacts towards the marine water quality during the construction of the retaining walls. There will be increase in turbidity, total suspended solids and other water quality values for an organism to live. This in particular will affect the area to be confined inside the retaining walls and the areas immediately adjacent to the retaining walls.

- *This impact is temporary only during the construction of retaining wall. The marine ecology and water quality will revive after the construction of the retaining wall. The proponent shall make sure that there will be less destruction and alteration of water quality in the site and make sure that it will be confined within the proposed site for the project.*
- *During reclamation activities, the only affected environment is the area within the retaining walls. Remaining fauna shall be collected and transferred to area outside the walls. The remaining sea water impounded within will be pumped out to make the landfill site dry.*
- Degradation by Raw Sewage and Fecal Matter

The absence of wastewater treatment facilities for the workers could introduce raw sewage and fecal matter into the coastline that could likely lead to increase the coliform level of the area and may degrade further the already degraded coastal marine ecosystem and the marine water quality.

- *A sewerage treatment facility must be provided on the field office within the site during construction stage. The quality of the effluent should conform to the DENR regulations.*

##### 5.1.2.2. Physical Impacts

###### Impacts to Land

- Generation of Solid Wastes and Construction Wastes
- *The contractor shall provide solid waste disposal area for the garbage of the construction workers in strategic places. Construction wastes shall be cleaned immediately and haul back to the construction yard or storage within the field office parking area.*

### Impacts to Air

- Air Pollution Caused by vehicles and equipment
  - *Vehicles and equipment shall be maintained properly. Dust generating areas shall be frequently sprinkled with water to prevent dust pollution.*
- Noise Generation from vehicles and equipment
  - *Schedule construction activities during daytime. Regular maintenance of equipment and vehicles to prevent noise. Installation of adequate mufflers on noise producing equipment and vehicles.*

### 5.1.2.3. Social Impacts

#### Impacts to People

- Generation of Employment
  - *Local hiring shall be prioritize except for highly technical works that needs experts.*

#### Safety

- Occupational Hazards. These includes physical injuries arising from accidents such as being hit by falling weak structures, being overrun by heavy equipment and etc.
  - *Use of proper personal protective equipment (PPE) such as hard hats, gloves, steel toe boots, etc. during working hours*
  - *Provide safety training and educational drive to construction workers and personnel.*
  - *Safety, health and educational drive should be given to residents living near the construction site.*
  - *Clear safety warning signs should be placed along strategic locations within the construction site*
  - *Safety and warning devices such as reflectors, lights, etc. shall be installed at designated spots.*

### 5.1.3. Operation Phase

#### 5.1.3.1. Ecological Impacts

##### Potential Impacts Associated with Marine Ecology and Water Quality

Most of the impacts of the secured landfill project will be focused on the area where the landfill facility is developed, the existing fishpond. The existing marine flora and fauna may be directly affected during and other construction activities.

There will be a decrease in the population of planktons, macrobenthic, flora and fauna, fishes due to water turbidity and filling of the area. The condition will suffocate the organisms specially the macrobenthic flora and fauna. Photosynthesis by the phytoplanktons and algae in the area will be affected because less light can penetrate turbid water. This will result to a decrease in primary productivity. There will also be less oxygen for the macrobenthic fauna due to fine sediments settling to the bottom resulting in H<sub>2</sub>S formation especially in areas with poor water circulation.

- Fine material run-off is likely to originate from the landfill facility, including the waste stockpile area, road surfaces and embankments. During heavy downpour, the fine materials are projected to be transported down to the lower areas and could find its way into the sea. Likewise, siltation is likely to cause a rise in turbidity that could degrade



the marine water quality. Considering that the waste material dumped is Coal Ash, its spillage and contamination of sea water may probably cause detrimental effects to marine life and water quality.

➤ *To mitigate this impact, the retaining wall or embankment will have to be maintained. Retaining walls and embankments are shielded with Geotextile Cloth and High Density Polyethelene Liner to prevent siltation and percolation of fill materials and seepage into the marine waters. The proposed Secured Landfill area shall be completely dried up before filling of coal ash. Reclamation using limestone as filling materials shall be filled first before dumping coal ash. With the mitigating measures, the only affected area will be confined only within the area to be develop. Since that part of the habitat of the marine flora and fauna is destroyed, these species will eventually transfer to nearby habitats not affected by the project.*

- Destruction of the Mangrove Forest

The area adjacent to the site has mangrove trees that are growing along tidal mudflat. Unmitigated filling activities could adversely affect the mangrove area.

➤ *The mangrove areas will not be included in the landfill facility. The mangrove habitat shall serve as a barometer species if ever there will be detrimental impacts as result or generated from the secured landfill facility. The proponent shall ensure protection and conservation of this mangrove habitat near the project site. The preservation of this mangrove forest is part of the responsibility of the proponent.*

- Reduced Water Quality due to dumping of filling materials

Fine material run-off is likely to originate from the landfill area, including the waste stockpile area, coal ash materials, road surfaces and embankments. During heavy downpour, the fine materials are projected to be transported down to the lower areas and could find its way into the sea. This condition is likely to degrade or adversely affect the marine ecosystem.

Likewise, siltation is likely to cause a rise in turbidity that could degrade marine water quality.

➤ *Structural protection such as retaining wall or embankment is already constructed as mitigating measures and will have to be maintained. Retaining walls and embankments are shielded with Geotextile Cloth and High Density Polyethelene Liner to prevent siltation and percolation of fill materials and seepage into the marine waters. The proposed Secured Landfill area shall be completely dried up before filling of coal ash. Limestone filling materials shall be filled firs before dumping coal ash. The outer basal mound of the rubble mound revetment(to takes the brunt of the wave action striking the slope and the irregular surfaces and instertices between the rocks will be effective in dissipating wave energy and minimizing reflected waves. The sea walls must be built on solid rock foundation otherwise wave action can only undermine them. With the mitigating measures, the only affected area will be confined only within the area for landfill.*

- Degradation by Oil and Grease, and Hazardous Wastes

The heavy equipment will need fuel and lubricants both for the operation and maintenance. When oil and other wastes are not handled properly or when there are accidental spills, these could be transported by surface runoff into the coastline, block off photosynthesis and other food processes. These pollutants are likely to increase the BOD and lower the DO levels of the waters. This condition is likely to degrade further an already degraded coastal marine ecosystem. Oil and grease may also contaminates the soil and the groundwater and which could find its way into the coastline because of the likely direction of groundwater flow..

➤ *All waste oil should be stored and disposed of according to acceptable oil industry standards.*

- *The proponent shall provide dust control of all excavations, material sites, roads, and disposal areas within its assigned areas of responsibility and shall provide suitable equipment, facilities, and precautions to eliminate the discharge of any contaminants to the environment.*

The coal ash dumped in the landfill if not carefully managed during transport and dumping will cause contamination and degradation of marine water quality.

- *Coal ash coming from the coal fired power plant transported into the landfill site shall be covered by a duly approved material during the transportation to minimize or eliminate spillage. Personnel will be assigned to spray water on the loaded truck to stabilize the dust particles. From the silo, the dump trucks will then travel to the truck scale for weighing. After weighing, the trucks will then proceed to the proposed Secured Landfill site for backfilling of coal ash. Along the hauling route, a water truck will be assigned to constantly water the road leading to the project site as may be required.*
- *All transportation equipment that hauls coal ash should be equipped with facility to eliminate spillage of coal ash during transport such as an effective cover material or enclosure to enclosed the coal ash*
- *During filling of coal ash into the secured landfill site, the contractor shall strictly makes sure that spillage of the coal ash into the marine waters outside the landfill is prevented. The retaining wall/embankment which will be constructed before filling will serve as the boundary of the secured landfill to the marine environment.*

#### **Potential impacts Associated with Terrestrial Ecology**

The direct impact area, the fishpond to be develop into a secured landfill is located in the coastal area. The impacts of the project in the terrestrial area is focused on the dusts and spillage of coal ash that might be experienced during the implementation of the project.

- Contamination of Terrestrial Environment caused by spillage of coal ash during transportation.
  - *Coal ash coming from the coal fired power plant transported into the Secured Landfill site shall be covered by a duly approved material during the transportation to minimize or eliminate spillage. Personnel will be assigned to spray water on the loaded truck to stabilize the dust particles*
  - *All transportation equipment that hauls coal ash should be equipped with facility to eliminate spillage of coal ash during transport such as an effective cover material or enclosure to enclosed the coal ash.*

#### **5.1.2.2 Physical Impacts (Land, Air and Water)**

##### **Potential Impacts Associated with Geology and Hydrology**

The project is not likely to have a significant impact on the geology of the area. Rather, geology will influence the form, level and magnitude of impacts. The effects of the construction activities will include geological instability and disturbances, modification in landform and soil erosion that will stem from the breakage and movement of earth materials, etc. The potential impacts associated with geology and hydrogeology during construction phase are presented below.

- Soil erosion and siltation

Fine material run-off is likely to originate from the landfill area, including the waste stockpile area, coal ash materials, road surfaces and embankments. During heavy downpour, the fine materials are projected to be transported down to the lower areas

and could find its way into the sea. This condition is likely to degrade or adversely affect the marine ecosystem.

- *Structural protection such as retaining wall or embankment is already constructed before the actual filling of the area. Retaining walls and embankments are shielded with Geotextile Cloth and High Density Polyethelene Liner to prevent siltation and percolation of fill materials and seepage into the marine waters. The proposed landfill area shall be completely dried up before filling of coal ash. Limestone filling materials shall be filled first before dumping coal ash. The outer basal mound of the rubble mound revetment (to take the brunt of the wave action striking the slope and the irregular surfaces and interstices between the rocks will be effective in dissipating wave energy and minimizing reflected waves. The sea walls must be built on solid rock foundation otherwise wave action can only undermine them. With the mitigating measures, the only affected area will be confined only within the area to be filled up. Since that part of the habitat of the marine flora and fauna is destroyed, these species will eventually transfer to nearby habitats not affected by the project.*

- Change in landscape/landform

The change in landform and geomorphological features within the site is significant. A flat land is developed over what would have been a shallow marine environment. This impact is irreversible.

- *The enhancement work such as providing for green areas, tree planting, putting place of drainage and sewerage systems and other activities should be expected to leverage to a certain degree the adverse effects of the change in landform.*

#### **Potential Impacts Associated with land use**

The project site composed of damaged fishpond. Based on the Land Use, the area is an Industrial Area. The conversion of the fishponds into a land area after the operation of the landfill facility will still conform to the land use of the area based on the approved land use plan of the city.

#### **Potential Impacts Associated with Hydrology**

- Leachate contamination of coastal waters

Leaching does not exist before the project. Upon filling, possible leaching may occur if the retaining walls are not shielded with impermeable materials.

- *Retaining walls and embankments are shielded with Geotextile Cloth and High Density Polyethelene Liner to prevent siltation and percolation of fill materials and seepage into the marine waters.*

#### **Potential Impacts Associated With Air Quality**

The construction work within the site is expected to have an impact on the area's air quality primarily through elevated levels of fugitive dust and to a minor extent, NO<sub>2</sub> and SO<sub>2</sub>. Impact areas are the immediate vicinities of the access roads and landfill area.

- Dust

Fugitive dust is likely to be generated in the process of loading, hauling, stockpiling, excavation, etc. The fugitive dust is likely to come from the landfill site and the access roads. This condition will only be storable and temporary lasting only during the filling activity.

To effectively minimize dust generation to a safe level, the following dust control measures should be adopted:

- *Proper handling of filling materials ( coal ash and limestone)*
- *Spraying of water on access roads, haulage roads and other dust generating areas with the use of water trucks.*
- *Provision of dust respirators to equipment operators who are exposed to dust while operating their equipment.*
- *Tree planting on open and disturbed areas which will not be used by the operations.*

- **NO<sub>2</sub> and SO<sub>2</sub>**

The use of heavy equipment is likely to cause an increase in the concentration of SO<sub>2</sub> and NO<sub>2</sub>. However, such increase is not expected to cause significant impact on the over-all concentration of these pollutants in the area.

- *Implement a preventive repair and maintenance program to keep gaseous emissions low. Such measures are also intended to maintain efficiency and reduce operating cost*

- **Noise Pollution**

Construction works and hauling are likely to generate noise pollution in the area. The noise generators are the heavy equipment such as payloaders, rollers, dump trucks, etc.

- *The use of properly maintained heavy equipment fitted with appropriate mufflers or silencers;*
- *The work schedule shall be limited from 6am to 6pm.*
- *Special instruction to drivers and heavy equipment operators to use their engines properly, avoid excessive pumping on the fuel and use of horn.*
- *Planting of trees that could serve as sound buffers.*

- ** Other Potential Impacts**

- **Increase in Transport Movement**

The increase of transport movement that results from the transport of filling materials is likely to increase significantly. This condition is likely to affect the traffic within the hauling route. The hauling of fill material is temporary, which ceases upon the end of the operation of the landfill facility.

- *Hauling and delivery schedules should be well planned to minimize disturbance. Routes shall be carefully selected to avoid traffic congestion and allow safe and easy passage. Operations should be avoided during the early morning and late night to minimize disturbances.*
- *Traffic signs shall be placed in strategic places to make sure traffic congestion is minimized.*

- **Deterioration of the Access Roads and Vibrations**

Constant exposure of the road to the load of heavy equipment is likely to deteriorate the access roads. The effect is likely to be temporary, which ceases upon the end of the operation.

The passage of hauling trucks and heavy equipment could generate ground vibrations. This is likely to pose inconvenience to the residents (which is temporary) and is likely to affect road and ground conditions.

- *Selecting the appropriate type of equipment should be done. Vibration sensitive facilities will be avoided. Hauling trucks shall be operated at low speed to minimize vibration, promote road safety, etc.*

### 5.1.2.3 Socio-Economic Impacts (People)

#### **Generation of Jobs**

One of the positive economic impacts of the project is the generation of jobs to the people of the barangays. This will help solve the problem of unemployment, thus providing income to the people and increasing their disposable income.

- *The qualified people near the site and those within the City of Naga should be given priority in hiring personnel that may be needed during the operation of the secured landfill.*
- *Hired personnel shall be given pertinent training on the manner of filling works that will be implemented/ used for the project.*

#### **Increase in Business/Economic Activities**

The operation will create a multiplier effect where various economic activities will either be created or the existing ones will experience growth. This will lead to the creation of more jobs. Corollary to this, disposable income will also increase. Again, the potential for economic opportunity and growth will arise leading to the generation of more jobs. In effect, a growing cycle of economic growth and employment generation will arise.

#### **Increase in Indirect Revenues**

The improved economic condition and the growth of business activities will generate more revenues for the city of Naga and the Province of Cebu.

#### **Increase in Government Revenues**

The increase in business and other economic activities would likewise benefit the government through more taxes and revenues.

#### **Loss of Access of the Fishermen to the Sea**

The project site is not utilized by the fishermen as access to the sea considering that the area is a private property and its nearness to the port of Apo Cement has hindered the fishermen to use the area as docking for safety purposes against large ships that docks in the nearby port.

#### **Health**

- Possible occurrence /increase of gastro-intestinal and respiratory problems
- Possible occurrence/increase of water-borne diseases such as seabies, dermatitis and other fungal diseases.

- *All employees shall undergo regular check up with physician to ensure that they have good health.*
- *The City will provide regular medical practitioner for the regular checkup of the employees health.*
- *Conduct free clinic and medical mission to regularly check the health condition of the residents of the community*

#### **Safety**

- **Occupational Hazards.** These includes physical injuries arising from accidents such as being hit by falling weak structures, being overrun by heavy equipment and etc.
  - *Use of proper personal protective equipment (PPE) such as hard hats, gloves, steel toe boots, etc.*
  - *Provide safety training and educational drive to construction workers and personnel.*
  - *Safety, health and educational drive should be given to residents living near the site.*
  - *Clear safety warning signs should be placed along strategic locations within the site*
  - *Safety and warning devices such as reflectors, lights, etc. shall be installed at designated spots.*

# 6 ALTERNATIVES WITH OR WITHOUT THE PROJECT

## A. Physico-Chemical Environment

### ❖ Land

The land is owned by the Provincial Government. There will be no significant changes of the land since the owner has no plans for its use in the near future except for land development. If the area is not developed, there will be tendency that marine waters will be polluted and mangrove cut by nearby community for fuelwood.

### ❖ Water

Without the project, there is still contamination of the sea water since there is already coal ash that has been dumped within the proposed site during the past years. The proposed Secured Landfill Project can mitigate the negative impacts of the coal ash to the water.

The increase use of the amenities of the industry when the area is developed will possibly increase waste generation. Improper disposal of solid waste affect the condition of seawater. Another possible consequence is the increase consumption of already inadequate supply of potable water in the area. In the case of the Secured Landfill, contamination of the sea water from filling materials may likely occur if not properly mitigated. Without the development of the project, there is still a possibility of water contamination due to the presence of APO Cement Company and its port and the community of Barangay Tinaan that may throw wastes into the sea.

### ❖ Air

Air quality will not be affected with or without the project considering the nearness of the National Highway wherein all vehicles passes from the city to the southern part of the province.

## B. Biological Component

### ❖ Terrestrial flora and fauna

Since there will be no plans for the use of land, the number of species living the area will generally remain the same.

### ❖ Aquatic flora and fauna

The condition of aquatic flora and fauna will still be the same but not an assurance that there will be no degradation that may occur in the area considering that there is already unconfined coal ash that has been observed dumped within the site during the years past. The implementation of the project will rest assure that these already dumped coal ash will be properly contained thereby assuring that there will be no degradation on the marine flora and fauna near the project site.

## C. Human Environment

### ❖ Demography

The population of both direct impact zone and the indirect impact zones are expected to increase because of the presence of the industries that will rise after the land development. Presence of migrant workers maybe experienced in the future.

Without the project, relatively there will be no immediate increase in the population of the area

caused by migrant workers.

❖ **Community**

The project can create bigger opportunities to the community particularly for employment and community services which will be given by the city and the locators of the area. After the operation of the Secured Landfill Project, the area will be open to land development projects. The project will become a door for investors to invest within the area and through these investors the city and province can acquire revenue that is transformed into services to the community. If there will be no development in the area, the fishpond will remain the same and contaminated.

❖ **Health**

Health related diseases as result during the implementation of the project will still likely to occur even without the project considering the immediate changes of the climate presently. Health problems as a result to coal ash contamination may likely to occur only on the level of the coal ash contents that is beyond the standards set. Its effects towards the health of the people within the city will not be relevant issue.

❖ **Economy**

Economic situation without the project could mean collection of lesser potential income in terms of tax revenue of both the LGU and the national government. This is because the potential tax income from the operation of the project will not be realized if it would not push through. Also, projected earnings from employment, and related activities that supplement the areas operation would be foregone.

Non-pursuit of the project would mean foregone income during the operation phase of the project as well as during the abandonment and conversion of the area into a land development area. This means that the projected increase in the number of small enterprises, such as carenderia and sari-sari store may not take place. Moreover, the potential employment and earnings that would be generated during this stage will not be realized. There would also be a concurrent implication to the construction industry if the project will not be undertaken. Also, construction materials needed for the project that would be procured locally, which translate to construction industry earnings will not be realized.



# 7 ENVIRONMENTAL MANAGEMENT PLAN

## 7.1 Impact Management Plan

An environmental management plan presents measures that will address the likely impact of the project—that is from conceptualization to project implementation or operation. Moreover, the EMP serves as a mechanism that will strike a balance between economics and ecology. This principle is translated on the EMP—serving as their eventual environmental policy during its entire project operation

The adverse environmental impacts generally are felt in the long –term, there is often a lack of awareness of how decisions are made today and affect the environment in the future. This results from the inability, or perhaps simply the lack of interest, in paying for the true cost of development. This means paying for the processing, use and disposal of products to minimize adverse environmental impacts.

### 7.1.1 Pre-Construction Phase

Before any construction will be done, the proponent shall complete to secure all necessary permits, clearances and studies needed for the project.

### 7.1.2 Construction Phase

#### 7.1.2.1 Construction of Retaining Walls

The retaining wall is constructed to contain waste material (coal ash) during filling. Its construction will be done before any filling activities. The retaining wall will prevent siltation and soil erosion of filling materials during filling.

Structural protection such as retaining wall or embankment will have to be constructed before the actual filling of the area. Retaining walls and embankments are shielded with Geotextile Cloth and High Density Polyethylene Liner to prevent siltation and percolation of fill materials and seepage into the marine waters. The proposed secured landfill site shall be completely drained with water and completely dried up before filling of coal ash. Limestone filling materials shall be filled first before dumping coal ash. The outer basal mound of the rubble mound revetment(to takes the brunt of the wave action striking the slope and the irregular surfaces and instertices between the rocks will be effective in dissipating wave energy and minimizing reflected waves. The sea walls must be built on solid rock foundation otherwise wave action can only undermine them. With the mitigating measures, the only affected area will be confined only within the area to be filled. Since that part of the habitat of the marine flora and fauna is destroyed, these species will eventually transfer to nearby habitats not affected by the project.

#### **7.1.2.2 Construction of adequate Drainage System**

An appropriate drainage system shall be constructed to cater rainwater and minimize runoff that could contaminate the sea water and degrade the area. A settling basin will be incorporated in the drainage system.

#### **7.1.2.3 Construction of Sewerage Treatment Facility**

A sewerage treatment facility must be provided on the site during construction stage. The quality of the effluent should conform to the DENR regulations.

#### **7.1.2.4 No Cutting of Mangrove Forest and Provide Green Area**

The project shall implement no cutting of mangrove forest. The mangrove forest will be segregated outside the project site. Green areas shall be provided within the area to recompense damage of natural vegetation. This will be conducted right after filling activities.

#### **7.1.2.5 Provide Standard Operating Procedure for the collection and disposal of used oil, grease and hazardous wastes**

Spills of oil and grease especially in the equipment maintenance area should be avoided by good housekeeping, regular inspection of working areas, provision of waste containment area for filters and other consumables, and proper maintenance of the oil-water separator.

All waste oil should be stored and disposed accordingly to acceptable oil industry standards. Washing down water also needs to be directed into this system and held retention areas for treatment.

The proponent will implement preventive repairs and maintenance program to keep the gaseous emissions low. Such measures are also intended to maintain efficiency and reduce operating cost.

The proponent shall provide dust control of all excavations, material sites, roads, and disposal areas within its assigned areas of responsibility and shall provide suitable equipment, facilities, and precautions to eliminate the discharge of any contaminants and noise level to the environment.

#### **7.1.2.6 Cover Hauling Truck and regular watering of stock pile filling materials**

An agreement with the contractor and to all suppliers of filling materials to cover hauling trucks while in transit and to seal flooring of trucks to avoid spillage on the road shall be done.

Regular watering of stockpiles shall be strictly implemented.

#### **7.1.2.7 Provide Mufflers and Silencers**

Make sure that all equipment used has efficient mufflers and silencers to minimize noise emissions.

#### **7.1.2.8 Installation of traffic signs and Detours**

Have traffic signs made in coordination with the City's Engineering District. If necessary, there will be re routing of traffic to avoid accidents and inconvenience during hauling of materials.

### 7.1.2.9 Prioritize Hiring of Local Workers

The proponent shall prioritize hiring of qualified workers within the municipality.

### 7.1.2.10 Provide access of fishermen to the sea

The proponent shall provide an area for access of fishermen to the sea.

### 7.1.2.11 Provide Personnel Protective Gears, First Aid Kits, Medicines and a stand by medical Practitioner

The proponent shall have a Safety engineer to oversee health hazards over the personnel all throughout the Secured Landfill Project. A standby medical practitioner shall be also hired for emergency situations.

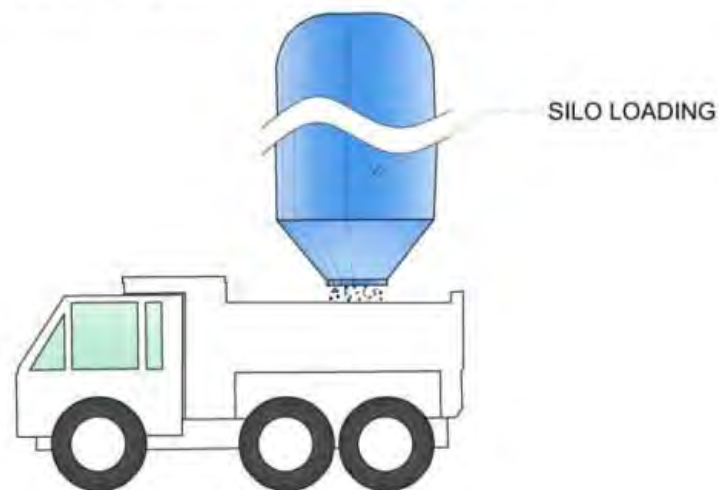
## 7.1.3 Operation Phase

### 7.1.3.1 Hauling of Coal Ash from Power Plant to Secured Landfill

#### (e) Loading and Transportation of Ash

- A monitoring team will be organized by FDRC to constantly monitor the activities of its personnel and to ensure that these are done in accordance with DENR-EMB standards and procedures in handling the agreed works.
- Ash discharge coming from KSPC will be loaded into a dump truck through a silo. It should be noted that the ash shall be loaded in such a way that spillage will be avoided. Dump trucks will be retrofitted in such a way that the cargo box opening will match that of the silo's opening. With this, only a small portion of the opening will need to be covered. Four (4) units of dump trucks, with 20 tons capacity each, will be assigned while one (1) unit spare dump truck will be on standby in case of breakdown of any of those in the project.

#### SILO TO DESIGNATED DUMP SITE



#### STEP 1. LOADING OF FLY ASH FROM SILO

- Loaded ash shall be covered by a duly approved material during the transportation to minimize or eliminate spillage. Personnel will be assigned to spray water on the loaded truck to stabilize the dust particles. From the silo, the dump trucks will then

travel to the truck scale for weighing. After weighing, the trucks will then proceed to the proposed Secured Landfill site for backfilling of coal ash. Along the hauling route, a water truck will be assigned to constantly water the road leading to the project site as may be required.



(f) Dumping of Ash

- The ash weight of all trucks coming in shall be checked before dumping. Manpower will also be assigned on the backfilling area for watering the ash especially those about to be dumped to minimize dusts. Water will be sourced from the sea and water will be controlled for just moistening the materials. Directional signs and traffic controls will be established at the landfill facility for proper guidance on priority areas and on the use of dumping equipment.

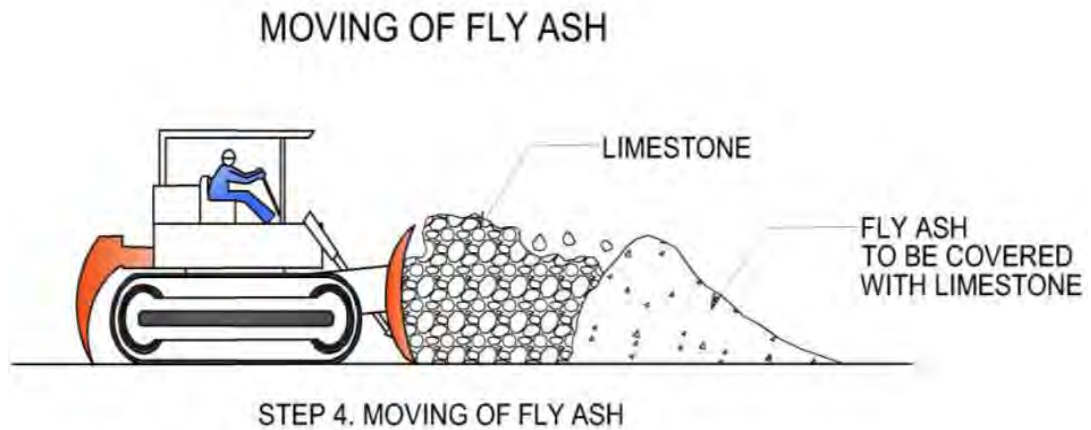


(g) Moving of Ash

- Ash unloaded on the landfill facility will be spread throughout the landfill using a dozer or its equivalent. The ash will then be gradually covered with or topped by soil and/or limestone until each portion of the area is filled up with ash and limestone. For easy

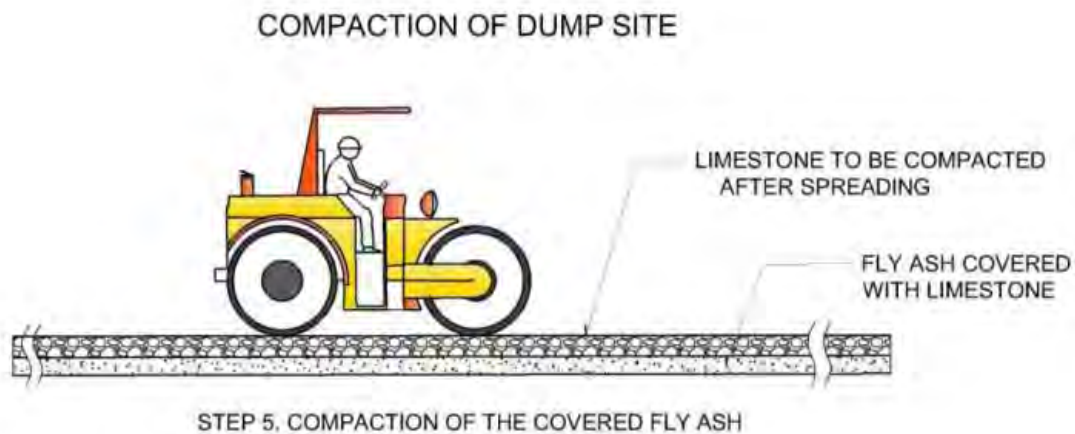
access of the dumping equipment, road network on the Secured Landfill site shall be developed and it shall be compacted.. The road shall be maintained in such a way that it will still be open for traffic for any weather condition. The finished top elevation of the landfill will be 2.65 m (+ 1.96 mean MSL) .

- o A water truck will be on standby for the watering of the ash deposited to the landfill facility.



(h)      **Compaction of Ash**

- o To reduce the dumped ash physically and to enhance the compaction of landfill facility, a roller will be used. The top soil of the dump site will be protected from wind blows because of the designed elevation of the landfill facility and the compaction will be useful in the soil stabilization of the area for future usage.
- o If necessary, greening and vegetation in the area, especially on the perimeter of the property will commence.



The landfill facility shall be filled with (limestone and coal ash). Backfilling shall be done in horizontal layers not exceeding 200 mm (8 inches, loose measurement, and compacted as specified before the next layer is placed. The ash will then be gradually covered with or topped by soil and/or limestone or any suitable backfill materials until each portion of the area is filled up with ash and limestone. Effective spreading equipment shall be used on each lift to obtain uniform thickness prior to compacting.

Continuous leveling and manipulating is required to assure uniform density. Water shall be added, if necessary to assure uniform density and to prevent dust emission.

### **7.1.3.2 Health and Safety**

#### **🏠 Health**

- Possible occurrence /increase of gastro-intestinal and respiratory problems
- Possible occurrence/increase of water-borne diseases such as seabies, dermatitis and other fungal diseases.
- *All employees shall undergo regular check up with physician to ensure that they have good health.*
- *The City will provide regular medical practitioner for the regular checkup of the employees health.*
- *Conduct free clinic and medical mission to regularly check the health condition of the residents of the community*

#### **🏠 Safety**

- Occupational Hazards. These includes physical injuries arising from accidents such as being hit by falling weak structures, being overrun by heavy equipment and etc.
  - *Use of proper personal protective equipment (PPE) such as hard hats, gloves, steel toe boots, etc. during working days.*
  - *Safety Engineer shall be made available and responsible for safety measures during operation.*
  - *Provide safety training and educational drive to construction workers and personnel.*
  - *Safety, health and educational drive should be given to residents living near the site.*
  - *Clear safety warning signs should be placed along strategic locations within the site*
  - *Safety and warning devices such as reflectors, lights, etc. shall be installed at designated spots*

### **7.1.3.3 Protection and Rehabilitation Activities in Mangrove Area**

### **7.1.3.4 Regular Assessment of Retaining Walls and Embankments**

### **7.1.3.5 Maintenance of Waste Water Treatment Facilities**

## **7.2 Environmental Monitoring Plan**

Environmental Monitoring is a very important activity done in order to ensure environmental protection and management in the project site, which include protection of the people and the environment and project sustainability. Environmental Program activities should be designed to properly conduct the activities on schedule and to come-up reliable results. Results of the monitoring activities are very important because it tells us the present

condition of the operating project and gives basis in improving activities having negative impacts so that it will be properly mitigated.

To ensure effective monitoring activities, the monitoring team should be multi-represented by experts coming from different government and non-government agencies with high regard on environmental protection and management. This will be done to exercise the expertise of the office concerned in order to come-up a sound management for the environment.

Regular monitoring of environmental aspects that can likely be affected during construction and operation of the Secured Landfill project site shall be monitored, sampled and analyzed periodically. The proponent shall coordinate with the Environmental Management Bureau for the formation of the Multipartite Monitoring Team that is responsible for the monitoring. The budget for the creation and operationalization of the team shall be incorporated with the operational budget of the project. In this case, the Provincial Government of Cebu shall ensure the appropriate budget.

The proponent must allocate money as Environmental Guarantee Fund of the project. This shall be used for the rehabilitation and/or restoration of damaged area, compensation for damages in life, health and property, support of nearby protected areas to enhance environment and implementation of community development programs.

The EGF shall be in three forms,

- 1) Trust Fund (TF);
- 2) Environmental Guarantee Cash Fund (EGCF), and
- 3) Community Projects Fund (CPF). Each form has separate bank accounts, which the proponent should set up. An EGF committee shall be formed, which will be responsible for the management of the fund

The Trust Fund shall be in the form of insurance for at least 1 million pesos. It shall be reviewed, received and or increased every 5 years if exhausted and when deemed necessary by the EGF committee. It shall be used for rehabilitation, support resource management and conservation such as terrestrial and marine protected areas, and to indemnify damaged properties due to the operation of the establishment and resolving complaints during the operation of the project.

The Environmental Guarantee Cash Fund (EGCF) shall be set for an initial amount of 1 million pesos and replenishable at a level set by the Committee. It shall be automatically disbursed by the Committee in an "as need" basis. This is to be used for information and dissemination program, skills training and the like.

The Community Project Funds (CPF) shall be set for an amount of at least one hundred thousand pesos. This is to be used for its community development projects. The amount shall be disbursed yearly, or upon any favorable arrangement between the proponent and barangay officials of Tinaan.

#### Environmental Monitoring Fund (EMF)

The proponent, through the project manager, shall allocate an initial amount of one hundred fifty thousand pesos for the Environmental Monitoring Fund. It shall be allocated and administered by the project manager annually in accordance with the environmental monitoring plan detailed above, upon approval of the plan by the MMT. It shall serve as a revolving fund for the MMT during the conduct of the monitoring plan indicated, and in the implementation of the conditions of the ECC. This includes transportation cost, meeting, sampling, hiring of expert, laboratory analysis, and documentation and public information sharing.

### 7.3 Institutional Plan

To ensure the maintenance and upgrading of the environmental condition of the Secured Landfill Project, the following must be implemented.

- Waste management shall be regularly monitored by the top management;
- Waste management information programs will be conducted annually;
- Meetings with the various levels of the organization will be conducted on a regular basis to upkeep the management goals, programs and services, looking into various environmental components;
- Conduct free clinic and medical mission to regularly check the health condition of the residents of the community;
- Implement community relations programs, such as feeding programs, skills development trainings and scholarship programs;
- Conduct an annual tree-planting and reforestation program;
- Conduct an annual coastal clean-up program; and
- Conduct seminars to educate the community about coal ash.



## 8 CONCLUSION AND RECOMMENDATION

The Secured Landfill Project of the **23.2** hectares of property of the Provincial Government of Cebu will mitigate the indiscriminate dumping of coal ash from the Coal Fired Power Plant. The project will give a secure area for dumping of coal ash.

Based on the result of the Initial Environmental Examination (IEE), the project management ensures all mitigating measures and enhancement measures for relevant negative and positive impacts foreseen during the implementation of the project. The project expects the project to become a area for proper and responsible coal ash disposal from Coal Fired Power Plant operated by Kepco as well as to contribute for the improvement of the economy, income of the people and increase in revenue of the city as well as a clean environment.

## 9 BIBLIOGRAPHY/REFERENCES

- Municipality of Naga.** Comprehensive Land Use Plan of the Municipality of Naga, Cebu. 1996-2005
- Salcon Power Corporation –KEPCO Philippines, Corp** Environmental Impact Statement. Coal Fired Thermal Power Plant Project,. 2005
- Tapobrata Sanyal.** Prospective Application of Jute GeoTextiles.
- KEPCO SPC Power Corporation.** Ash Disposal Plan of Cebu Coal Fired Power Plant
- Brooks, Gene.** Environment, Process and Development. New Jersey: Prentice Hall, 1988
- Canter, Larry W.** Environmental Impact Assessment, New York, Mc Graw-Hill, Inc. 1996
- Colley, B. C.** Practical Manual of Site Development. New York, Mc Graw-Hill, Inc. 1986
- EMB- Environmental Impact Assessment and Management Division (EIAMD).** Revised Procedural Manual for DAO 30-2003. August 2007
- Madulid, Domingo.** Dictionary of Philippine Plant Names, Volume II
- DAO 2003-30
- DAO 34
- DAO 35
- Environmental Geology 6<sup>th</sup> edition by Keller

## 10 ANNEXES

- Impact Management Plan Matrix
- Environmental Monitoring and Management Plan with EQPLs
- Site Development Plan
- Stone Masonry/Armour Rock Retaining Wall Design
- Design of Retaining Wall
- Drainage Plan
- Cross Section of Drainage Structure
- Road and Drainage Section-Asphalt and Concrete Pavement
- Pictures ( Primary and Secondary Impact Areas )
- Coal Ash Composition
- Topographic Map
- Scoping Activity (Public Consultation )
- Sworn Accountability Statement of the Proponent
- Sworn Accountability Statement of IEE preparers

### IMPACT MANAGEMENT PLAN MATRIX

<b>Project Phase / Environmental Aspect</b> (Project Activity Which Will Likely Impact the Environmental Component)	<b>Environmental Component Likely to be Affected</b>	<b>Potential Impact</b>	<b>Options for Prevention or Mitigation* or Enhancement</b>	<b>Responsible Entity</b>	<b>Cost</b>	<b>Guarantee / Financial Arrangements</b>
<b>I. PRE-CONSTRUCTION PHASE</b>	<b>(include only applicable modules )</b>					
Environmental Aspect # 4	B. The People		Conduct Public Hearing prior to construction	Cebu Provincial Government,	10,000.00	Minutes of Public Hearing
<b>II. CONSTRUCTION PHASE</b>	<b>(include only applicable modules)</b>					
Environmental Aspect # 1	A. The Water	Destruction of marine ecosystem within the project site during construction of retaining walls	Destruction is limited only on the on areas develop as Secured Landfill.  The marine fauna affected inside the area for landfill will eventually transfer to more suitable environment	Proponent/contractor	50,000.00	MOA with Contractor
		Increase siltation caused by runoff and increase turbidity of sea water outside	Structural protection such as retaining wall or embankment will have to be constructed before the actual filling of the area. Retaining walls and embankments are shielded with Geotextile Cloth and High Density Polyethelene Liner to prevent siltation and percolation of fill materials and	Proponent/contractor	Included in the project cost	Project Development Plan

<b>Project Phase / Environmental Aspect</b> (Project Activity Which Will Likely Impact the Environmental Component)	<b>Environmental Component Likely to be Affected</b>	<b>Potential Impact</b>	<b>Options for Prevention or Mitigation* or Enhancement</b>	<b>Responsible Entity</b>	<b>Cost</b>	<b>Guarantee / Financial Arrangements</b>
		to project site	seepage into the marine waters. The proposed landfill area shall be completely dried up before filling of coal ash. Limestone filling materials shall be filled first before dumping coal ash. The outer basal mound of the rubble mound revetment to takes the brunt of the wave action striking the slope and the irregular surfaces and interstices between the rocks will be effective in dissipating wave energy and minimizing reflected waves.			
		Contamination of sea water and destruction of marine life outside the landfill area due to spillage of filling materials	The proponent shall provide dust control of all excavations, material sites, roads, and disposal areas within its assigned areas of responsibility and shall provide suitable equipment, facilities, and precautions to eliminate the discharge of any contaminants to the environment.  Installation of Geotextile Sheet within the retaining walls and embankments  Construction of silt pond to pumpout run off water from the site.	Proponent	200,000.00	Clean Water Act/Provisions of ECC.
		Increase BOD level and decreases DO level caused	Collection of used oil, grease and waste materials in sealed containers and let contractor dispose or recycle properly.	Equipment operator CPG	20,000.00	ECC conditions, RA 6969

<b>Project Phase / Environmental Aspect</b> (Project Activity Which Will Likely Impact the Environmental Component)	<b>Environmental Component Likely to be Affected</b>	<b>Potential Impact</b>	<b>Options for Prevention or Mitigation* or Enhancement</b>	<b>Responsible Entity</b>	<b>Cost</b>	<b>Guarantee / Financial Arrangements</b>
		by degradation of Oil , Grease and Waste material into the sea from construction equipment	The proponent shall provide dust control of all excavations, material sites, roads, and disposal areas within its assigned areas of responsibility and shall provide suitable equipment, facilities, and precautions to eliminate the discharge of any contaminants to the environment			
		Increase sewage generation	Provide temporary toilet facilities among workers  Construction and maintenance of 3 chambered septic tank within the bunk house and operational center of the project	proponent	15,000.00	Clean water act
		Increase run off during rainy days	Provide adequate drainage system and catch basins within the drainage canals. Silt pond with series of silt traps shall be constructed.	Proponent	Included in the project cost	Drainage Layout
Environmental Aspect # 2	B. The Land	Change in landform and aesthetics	Plant green areas to compensate change in aesthetics within the land portion after construction of the landfill project	Proponent	20,000.00	Tree Planting Plan, ECC conditions
		Increase surface runoff , seepage and flooding	Provide adequate drainage system to accommodate peak runoff.  Silt Pond is constructed to pump our run off caused by heavy rainfall.	Proponent/ contractor	Included in the project cost	Drainage Plan

<b>Project Phase / Environmental Aspect</b> (Project Activity Which Will Likely Impact the Environmental Component)	<b>Environmental Component Likely to be Affected</b>	<b>Potential Impact</b>	<b>Options for Prevention or Mitigation* or Enhancement</b>	<b>Responsible Entity</b>	<b>Cost</b>	<b>Guarantee / Financial Arrangements</b>
		Mud formation	Roads are compacted to prevent mud formation caused by heavy equipment during transport of filling materials.  Provide Washing bays to clean truck tires before exit from the project site	Proponent	25,000.00	Project maintenance
		Generation of Construction Wastes	Provide area to stockpile construction wastes before hauling to contractors yard.	Contractor	15,000.00	Contract
		Generation of Solid Wastes from workers	Provide solid waste disposal area and implement segregation	Workers	5,000.00	R.A. 9003
Environmental Aspect # 3	C. The Air	Dust generation and increase in NO <sub>2</sub> and SO <sub>2</sub> level	Cover stockpiles of limestone to minimize dust blown by wind  Spray water on access roads, haulage roads and dust generating areas  Provision of dust respirators to equipment operators who are exposed to dust  Provision of tarpaulins used to cover trucks in the delivery of filling materials  Coal ash coming from the coal fired power plant transported into the Secured Landfill site shall be covered by a duly approved material during the transportation to eliminate spillage.	Contractor	50,000.00	Clean Air Act

<b>Project Phase / Environmental Aspect</b> (Project Activity Which Will Likely Impact the Environmental Component)	<b>Environmental Component Likely to be Affected</b>	<b>Potential Impact</b>	<b>Options for Prevention or Mitigation* or Enhancement</b>	<b>Responsible Entity</b>	<b>Cost</b>	<b>Guarantee / Financial Arrangements</b>
			All transportation trucks that hauls coal ash should have a facility or to eliminate spillage of coal ash during transport such as cover material or enclosure.			
		Increase in noise generation caused by pile drivers, hammer, heavy equipment and other noise generating equipment	Provide silencers and mufflers to minimize noise  Operation should be done only during daytime from 8 a.m. to 5 p.m.  Proper maintenance of the equipment and vehicles	Contractor/ Operators	20,000.00	Noise Standards, ECC conditions
	D. The People	Increase generation of employment	Prioritize local labor with consultation to the Barangay LGU	Contractor/ Proponent	Depends on wages	Labor Code, Civil Service Code
Environmental Aspect # 4		Increase indirect revenues	Pay taxes to Local government	Proponent	Tax rates applies	Revenue Code
		Occurrence of sickness and disease from workers and from the adjacent	Provide free medicines  Provide free clinic and medical mission to the local community	Proponent	15,000.00	Health and Safety Plan



<b>Project Phase / Environmental Aspect</b> (Project Activity Which Will Likely Impact the Environmental Component)	<b>Environmental Component Likely to be Affected</b>	<b>Potential Impact</b>	<b>Options for Prevention or Mitigation* or Enhancement</b>	<b>Responsible Entity</b>	<b>Cost</b>	<b>Guarantee / Financial Arrangements</b>
		community as caused by the project				
		Increase the risk from accidents	Workers must wear the provided Personal Protective Equipment during working hours at all times  All workers should pass training prior deployment to the project site  Hire medical professionals at the field site.  First Aid kit shall be made available at all times in the project site  Install warning signs along identified accident prone areas	Proponent	30,000.00	Project Management/ Safety Plan
		Increase traffic in the access road during hauling of materials	Provide appropriate traffic signs and install in strategic places and routes.  Schedule delivery during non peak hours	Proponent	5,000.00	Traffic Management
<b>III. OPERATION PHASE</b>	<b>(include only applicable modules)</b>					
Environmental Aspect # 1	A. The Land	Increase solid waste generation	Provide solid waste receptacles on strategic places. Implement garbage segregation.	Proponent	5,000.00	Project Management

<b>Project Phase / Environmental Aspect</b> (Project Activity Which Will Likely Impact the Environmental Component)	<b>Environmental Component Likely to be Affected</b>	<b>Potential Impact</b>	<b>Options for Prevention or Mitigation* or Enhancement</b>	<b>Responsible Entity</b>	<b>Cost</b>	<b>Guarantee / Financial Arrangements</b>
		Increase vehicular traffic	Provide appropriate traffic signs in strategic places  Assign traffic personnel to facilitate movement of vehicles in and out the site.	Proponent	25,000.00 per year	Project Management
		Maintenance of Plant Nursery and Tree Planting Area	Assign personnel for maintenance of the tree planting site.  Tree planting shall be conducted uphill portion of Naga. The proponent shall submit a work and financial plan for maintenance and planting to be coordinated with the City.	Proponent	120,000.00 per year	Environmental Protection and Enhancement Program
	B. The Water	Decrease in Mangrove Forest adjacent to the project site	The mangrove area will be protected by the Provincial Government against illegal cutting.  Protection, conservation and rehabilitation activities shall be implemented in coordination with other agencies	Proponent	60,000.00 per year	Project Management
		Contamination of sea water and destruction of marine life outside the landfill area	The proponent shall provide dust control of all excavations, material sites, roads, and disposal areas within its assigned areas of responsibility and shall provide suitable equipment, facilities, and precautions to eliminate	Proponent	200,000.00	Clean Water Act/Provisions of ECC.

<b>Project Phase / Environmental Aspect</b> (Project Activity Which Will Likely Impact the Environmental Component)	<b>Environmental Component Likely to be Affected</b>	<b>Potential Impact</b>	<b>Options for Prevention or Mitigation* or Enhancement</b>	<b>Responsible Entity</b>	<b>Cost</b>	<b>Guarantee / Financial Arrangements</b>
		due to spillage of coal ash and silt.	the discharge of any contaminants to the environment.			
		Increase BOD level and decreases DO level caused by degradation of Oil , Grease and Waste material into the sea	Collection of used oil, grease and waste materials in sealed containers and let contractor dispose or recycle properly.  The proponent shall provide dust control of all excavations, material sites, roads, and disposal areas within its assigned areas of responsibility and shall provide suitable equipment, facilities, and precautions to eliminate the discharge of any contaminants to the environment	Equipment operator  CPG	20,000.00	ECC conditions, RA 6969
		Increase siltation caused by runoff and increase turbidity of sea water outside to project site	Maintenance of the retaining wall or embankment. Retaining walls and embankments are shielded with Geotextile Cloth and High Density Polyethelene Liner to prevent siltation and percolation of fill materials and seepage into the marine waters.	Proponent/ contractor	Included in the project cost	Project Development Plan
		Contamination of aquifer from coal ash leachate	The based portion of the Secured Landfill project with remaining seawater is discharged with draining equipment and when depleted and dry, filled with limestone, leveled and laid with	Proponent	2 Million	Development Plan

Project Phase / Environmental Aspect (Project Activity Which Will Likely Impact the Environmental Component)	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
			Bentonite Clay Lining and High Density Polyethelene Sheet Liner. The Bentonite clay soil used in the first layer shows plasticity and hardened when dried. It becomes silicate bearing material which are very effective in preventing percolation of into the ground water which may adversely affect the water quality or will assimilate into the sea water eventually polluting the marine ecosystem. The substratum of the fishpond shall be leveled to allow proper and secure placement of HDPE lining prior to land filling. Regular monitoring of the retaining wall/embankment shall be conducted			
		Increase sewage generation	Provide and maintain effective sewage treatment facility to treat sewage before disposal and must pass DENR standards.  Desludging shall be conducted through the services of a private septage contractor	Proponent	30,000.00	Project Management
		Increase run off during rainy days	Provide maintenance of drainage system and catch basins within the drainage canals.  Maintenance of Silt Pond. Run off water in the landfill area will be pumped	Proponent	12,000.00 per year	Maintenance Plan

<b>Project Phase / Environmental Aspect</b> (Project Activity Which Will Likely Impact the Environmental Component)	<b>Environmental Component Likely to be Affected</b>	<b>Potential Impact</b>	<b>Options for Prevention or Mitigation* or Enhancement</b>	<b>Responsible Entity</b>	<b>Cost</b>	<b>Guarantee / Financial Arrangements</b>
			out to the silt pond.			
	C. The Air	Dust generation caused by vehicles	Frequent watering of access roads and keep it clean.  Maintenance of Wash Bay to wash out dirt from tires of hauling trucks before exit from the secured landfill.	Proponent	5,000.00	Project Management
		Spillage of coal ash in the roads and routes during transport	Coal ash coming from the coal fired power plant transported into the Secured Landfill site shall be covered by a duly approved material during the transportation to minimize or eliminate spillage. Personnel will be assigned to spray water on the loaded truck to stabilize the dust particles. From the silo, the dump trucks will then travel to the truck scale for weighing. After weighing, the trucks will then proceed to the proposed Secured Landfill site for backfilling of coal ash. Along the hauling route, a water truck will be assigned to constantly water the road leading to the project site as may be required.	Hauling Contractor	Included in the contract cost	MOA, Monitoring Plan
	D. The People	Increase employment and economic activity	Prioritize hiring of qualified workers within the city	Proponent	wages	Project Management / Labor Code

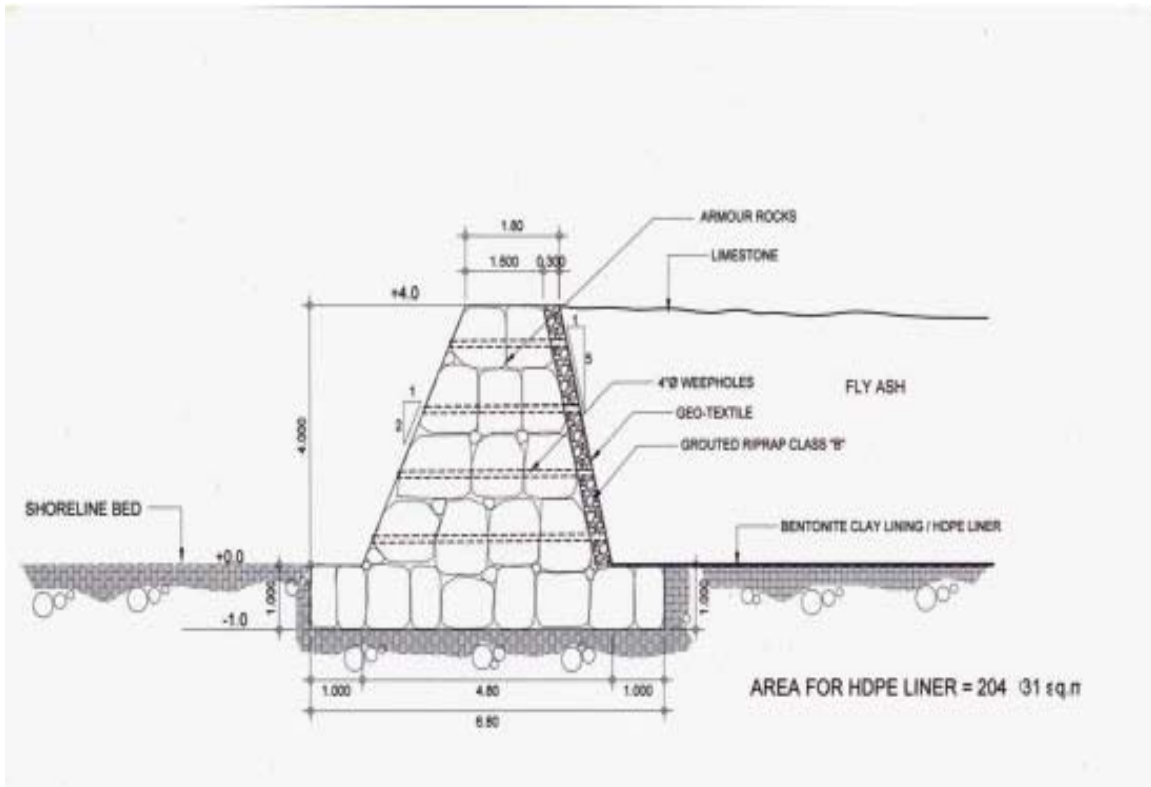
<b>Project Phase / Environmental Aspect</b> (Project Activity Which Will Likely Impact the Environmental Component)	<b>Environmental Component Likely to be Affected</b>	<b>Potential Impact</b>	<b>Options for Prevention or Mitigation* or Enhancement</b>	<b>Responsible Entity</b>	<b>Cost</b>	<b>Guarantee / Financial Arrangements</b>
		Improved Standard of living	Adequate salaries shall be given to workers	Proponent	wages	Project Management
		Possible Health and Safety problems related to landfill operations	<p>All employees shall undergo regular check up with physician to ensure that they have good health.</p> <p>Provide First Aid Kits within the Field Office</p> <p>The proponent will provide regular medical practitioner for the regular checkup of the personnel health.</p> <p>Conduct free clinic and medical mission to regularly check the health condition of the residents of the community</p> <p>Use of proper personal protective equipment (PPE) such as hard hats, gloves, steel toe boots, etc. during working hours at all times.</p> <p>Safety Engineer shall be made available and responsible for safety measures during operation.</p> <p>Provide safety training and educational</p>	Proponent	100,000 per year	Health and Safety Fund

<b>Project Phase / Environmental Aspect</b> (Project Activity Which Will Likely Impact the Environmental Component)	<b>Environmental Component Likely to be Affected</b>	<b>Potential Impact</b>	<b>Options for Prevention or Mitigation* or Enhancement</b>	<b>Responsible Entity</b>	<b>Cost</b>	<b>Guarantee / Financial Arrangements</b>
			<p>drive to construction workers and personnel.</p> <p>Safety, health and educational drive should be given to residents living near the site.</p> <p>Clear safety warning signs should be placed along strategic locations within the site</p> <p>Safety and warning devices such as reflectors, lights, etc. shall be installed at designated spots</p>			
<b>IV. ABANDONMENT PHASE</b>	<b>(include only applicable modules)</b>					
Environmental Aspect # 1	A. The Land	Construction wastes	All construction wastes shall be hauled by the contractor to its yard Monitor the disposal of construction debris and make sure no construction wastes are dumped in the sea.	Contractor		MOA with contractor
		Land Use Conversion	The area will be open for land development	Provincial Government		Land Development Plan

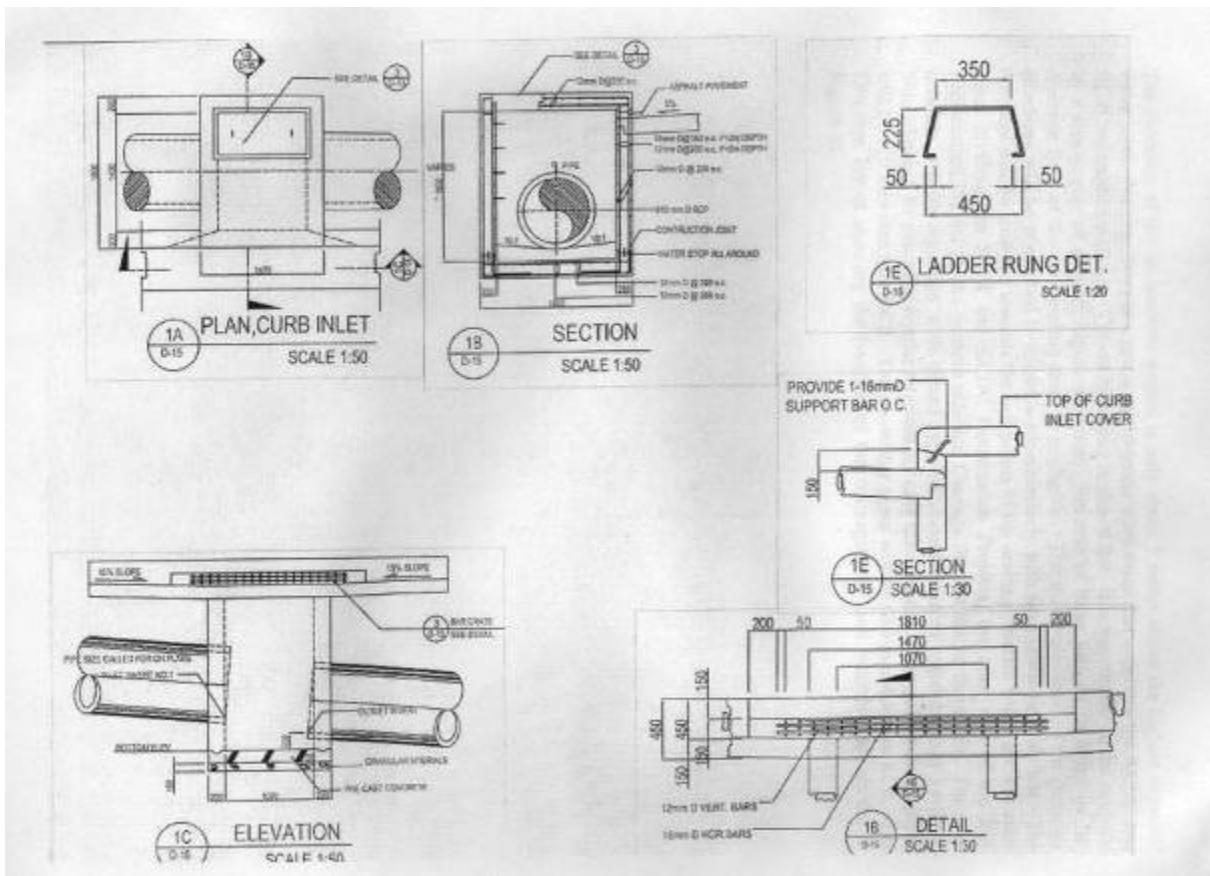
**ENVIRONMENTAL MONITORING PLAN (EMMoP)**

Key Environmental Aspects per Project Phase	Potential Impacts Per Env't'l Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EOPL MANAGEMENT SCHEME						
			Method	Frequency	Location			EOPL RANGE			MANAGEMENT MEASURE			
								ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT	
<b>II. CONSTRUCTION PHASE</b>														
Environmental Aspect #3 (Water)	Water Quality of nearby waterbody	BOD, pH, Coliform, DO, Heavy metals associated to Coal Ash		annually	Nearest water body	Proponent	100,000	20% of the standard	10% of the standard	TSS-50 BOD-30 Ph-5-8	Improve the treatment facility	Coordinate with EMB	Conduct sampling and analysis	
<b>III OPERATION PHASE</b>														
Environmental Aspect #2 (air)	dust	TSP level	sampling	once	Project site	proponent	5,000.00	20% of the standard	10% of 230ug/NCM	230ug/NCM	Install pollution control device	Coordinate with EMB for sampling and analysis	Conduct sampling	
Environmental Aspect #3 (Water)	Water Quality of nearby waterbody	BOD, pH, Coliform, DO, Heavy metals associated to Coal Ash		annually	Nearest water body	Proponent	100,000	20% of the standard	10% of the standard	TSS-50 BOD-30 Ph-5-8	Improve the treatment facility	Coordinate with EMB	Conduct sampling and analysis	
<b>IV. ABANDONMENT PHASE</b>														
Environmental Aspect #1														

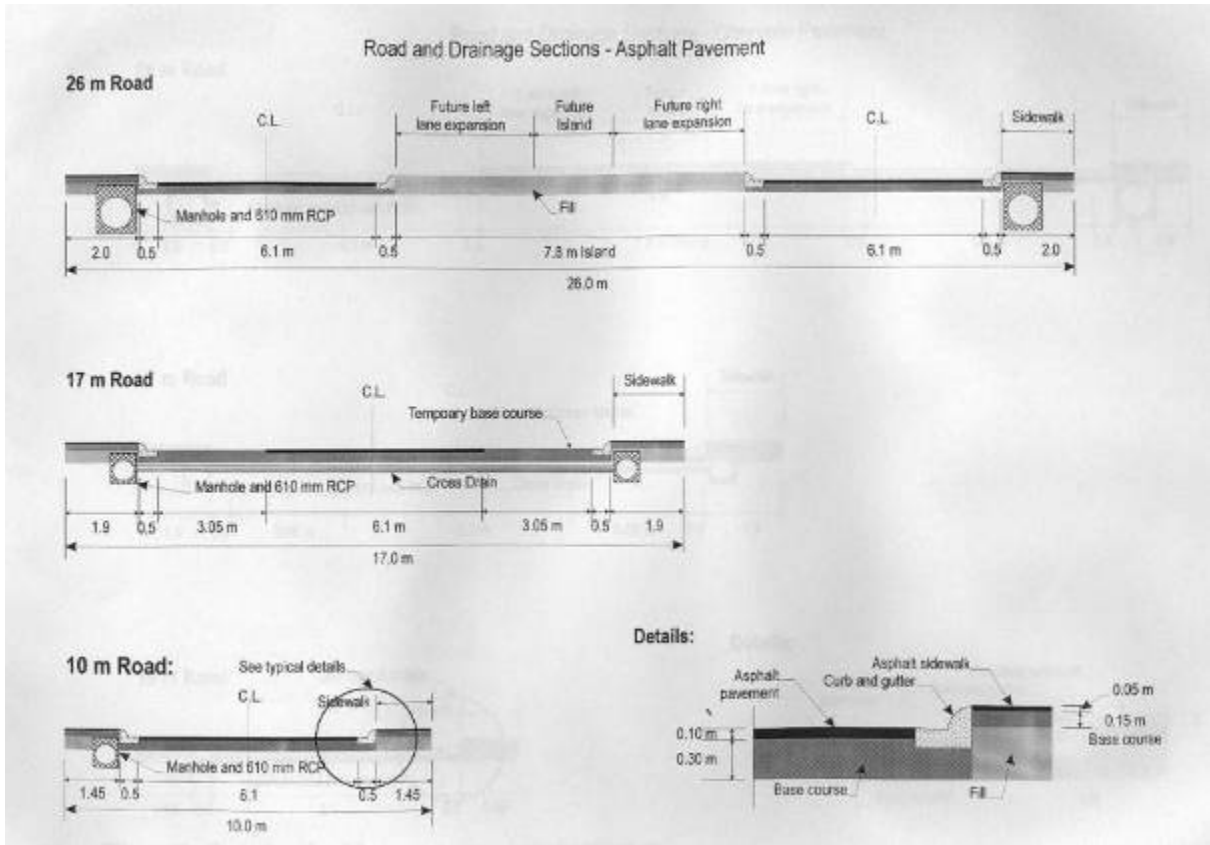




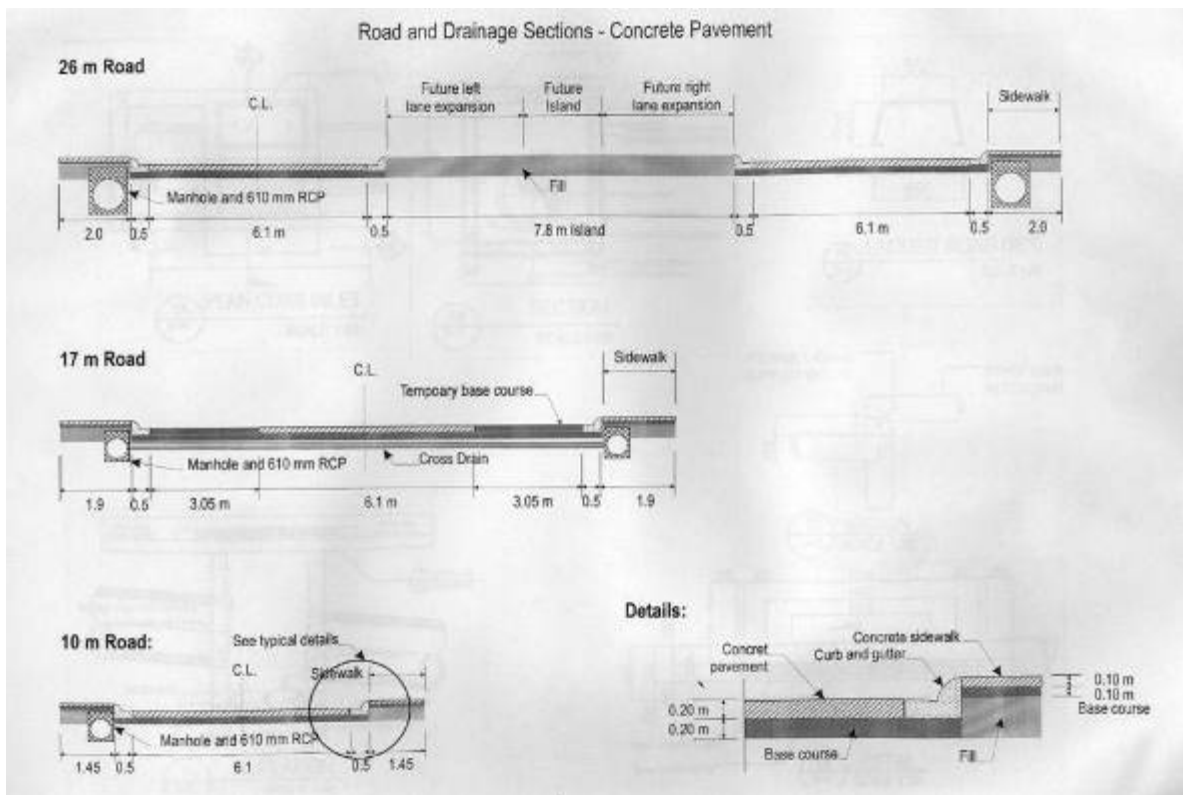
Stone Masonry/Armour Rock Retaining Wall Design



Cross section of Drainage Structure



Road and Drainage Section-Asphalt Pavement



Road and Drainage Section-Concrete Pavement

**PHOTOS OF THE PROPOSED SECURED LANDFILL PROJECT**





South Western Part of the Project Site



North Eastern Part of the Project Site



The secondary Impact areas from Brgy. Colon to Tinaan, Naga



Photos during gathering of water samples for water analysis

DESCRIPTION	UNIT	RANGE COAL	DESIGN COAL
Carbon	%Wt	Min. 70.0	73.0
Hydrogen	%Wt	Max. 10.0	5.7
Nitrogen	%Wt	Max. 2.0	1.4
Oxygen	%Wt	Max. 25.0	19.0
Sulfur	%Wt	Max. 2.0	0.9
<b>Higher Heating Value</b>			
As received basis	kcal/kg	Min. 4,000	4,500
Air dry basis	kcal/kg	Min. 4,900	5,400
Dry basis	kcal/kg	-	-
Initial Deformation Temperature (Reducing atmosphere)	°C	Min. 1,030	1,070
<b>Ash Analysis</b>			
SiO <sub>2</sub>	% Wt	30~ 60	47.0
Al <sub>2</sub> O <sub>3</sub>	% Wt	10 ~ 30	22.0
Fe <sub>2</sub> O <sub>3</sub>	% Wt	Max. 20	4.1
Na <sub>2</sub> O	% Wt	Na <sub>2</sub> O+K <sub>2</sub> O<3.5	1.5
K <sub>2</sub> O	% Wt	-	0.8
TiO <sub>2</sub>	% Wt	Max. 3.0	1.5
CaO	% Wt	Max. 13	8.3
MgO	% Wt	Max. 10	5.0
Others	% Wt	-	9.8

CEBU COAL FIRED POWER PLANT

Coal Ash Composition

II-1.4-5



ANNEX "A"

**SPECIFICATIONS FOR FLY ASH /BED ASH**

Chemical Analysis:

LOI	:	12% Maximum
Chloride	:	0.10% Maximum
SO <sub>3</sub>	:	<8% Maximum
MgO	:	<7% Maximum
Total Alkali	:	2.5 % Maximum
Al <sub>2</sub> O <sub>3</sub>	:	15% Minimum

Heavy Metal Contents:

The following TCLP (toxicity characteristics leaching procedure) concentrations shall not be exceeded:

As	:	5 mg/L
Ba	:	100 mg/L
Cd	:	5 mg/L
Cr (total)	:	5 mg/L
Pb	:	5 mg/L
Hg	:	0.2 mg/L
Se	:	1 mg/L
Ag	:	5 mg/L
Copper (Cu)	:	Not detectable
Antimony (Sb)	:	Not detectable
Zinc (Zn)	:	Not detectable

Physical Characteristics:

Size, Bed Ash	:	30 mm maximum
H <sub>2</sub> O, Fly Ash	:	3% Maximum
H <sub>2</sub> O, Bed Ash	:	5% Maximum

*Handwritten initials/signature*

EPC Contract

III-1.2-64

Volume III  
Technical Schedule

CEBU COAL FIRED POWER PLANT

KSPC (KEPCO-SPC POWER CORPORATION)

[Ash]	(kg/h)	(%)	BMCR	MCR	100%GNRC	75%GNRC	50%GNRC	37%GNRC
<b>A. Ash and dust quantities (Design Coal at BMCR)</b>								
1) Bed ash (from furnace bottom)	1,226	22.2						
2) Air preheater hoppers	198	3.6						
3) Electrostatic precipitator	4,100	74.2						
4) Total	5,524	100.0						
<b>(Range Coal at BMCR)</b>								
1) Bed ash (from furnace bottom)	Later	Later						
2) Air preheater hoppers	Later	Later						
3) Electrostatic precipitator	Later	Later						
4) Total	Later	Later						
<b>B. Expected ash size</b>								
1) 5 micron and smaller			%					
2) 5 micron to 50 micron	0.35 / 78	0.35 / 78	%	0.35 / 78	0.35 / 78	0.35 / 78	0.35 / 78	0.35 / 78
3) 51 micron and larger	99.65 / 22	99.65 / 22	%	99.65 / 22	99.65 / 22	99.65 / 22	99.65 / 22	99.65 / 22
<b>C. Unburned carbon content in refuse</b>								
1) Unburned carbon content in refuse	8	8	%	8	8	8	8	Later
2) Range of Unburned carbon content in refuse			%					
- max.	8	8	%	8	8	8	8	Later
- min.	5	5	%	5	5	5	5	Later

III-1.2-65

Amw

CEBU COAL FIRED POWER PLANT

Amw

Coal Ash Composition